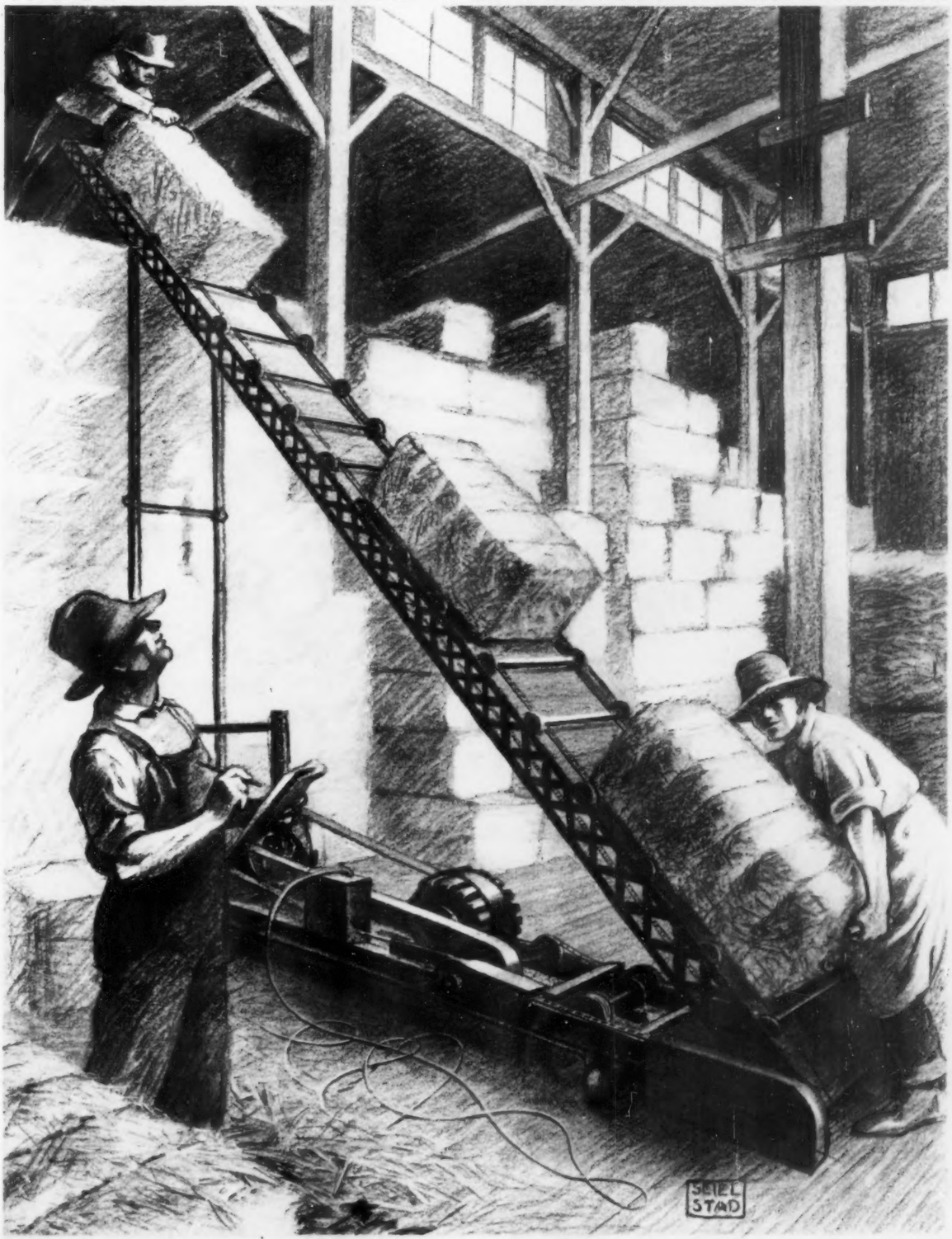
SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



STACKING UP BALED HAY WITH THE AID OF THE ELECTRICAL CONVEYOR—[See page 390]

Vol. CXXI. No. 16
October 18, 1919

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 10 Cents
$5.00 a Year

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879

Vacuum Oil Company
Warehouse at Bangkok, Siam

American Oils for Siam

Carrying Correct Lubrication to the Land of the White Elephant

THE following extracts are from the report of a representative of our Bangkok office after a trip he made to sell Gargoyle Lubricants in the wilds of Southwestern Siam, on the Malay Peninsula. His story gives some idea of the perils and hardships of his long journey through this wild untraveled country.

"One morning I determined to go inland to Gnow. Rode 8 miles on bicycle, by a jungle foot path under the blaze of a 160 degree sun . . . Came to in a tent with some one fanning and throwing water on me."

"At Petchaburi two rice mills secured us an order for one barrel Gargoyle Marine Motor Oil. The engineer, a Malay, expressed surprise at the little he has consumed. The Ban Pan Palace promised orders for two barrels for the traction engine and pump . . . "

"At Singora the proprietors of two mills adopted Gargoyle H H. Engine Oil and Gargoyle 600-W. Cylinder Oil. The motor cars here all use our Gargoyle Mobiloils."

"Wednesday . . . harbor of Puket . . . Tan Chen Hor, an educated Chinese, was quite pleased to get our agency."

"Thirty oil engines employing castor oil lubrication were clogged with a mass of black deposit. Put in our Gargoyle Etna Engine Oil."

"At Renong . . . a plant run by Australians . . . use 1500 barrels Gargoyle Lubricants annually."

" . . . with four men as rowers, we started up the 40 mile passage of Packchan River . . . squall . . . arrived Mamoo . . . encamped in a Chinese house to secure elephants for the next two days' travel. Only one for baggage . . . 42 miles on foot . . . leeches . . . tumbling streams . . tigers . . . leopards . . . the priest in his yellow robe."

* * *

In the map shown here, the red line indicates the course of the trip.

This representative was told by the authorities that he was probably the first white man to walk across the Isthmus of Kra.

Wherever machinery goes, scientific lubrication must follow. The work must go on.

GARGOYLE

Lubricants

A grade for each type of service

VACUUM OIL COMPANY — *Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world* — NEW YORK, U.S.A.

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXI
NUMBER 16

NEW YORK, OCTOBER 18, 1919

10 CENTS A COPY
$5.00 A YEAR

Nauen—Germany's Wireless Voice

AMONG the first photographs to be received from Germany, following the raising of the blockade, are the accompanying views of the famous wireless station at Nauen, near Berlin. Long ago Nauen became identified with German press dispatches, for all during the war the Germans made extensive use of this station for the transmission of propaganda to neutral and enemy countries.

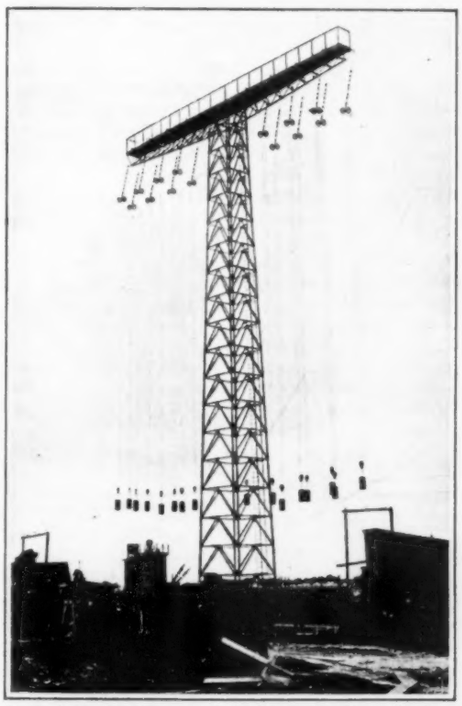
The Nauen wireless station is one of the most powerful in the world, maintaining communication with the largest wireless stations in the United States under normal conditions. The antenna system, it will be noted, is supported by a main tower and a number of smaller towers. A system of weights and pulleys maintains the antenna wires at the proper degree of tension.

The interior view of the Nauen station shows part of the transmitting equipment, including spark gaps, helices, condensers, meters, motor-generator set, and connecting panels. In the absence of definite data it is impossible to state just what apparatus is being employed at present, although it is known that the station is provided with several transmitters, like most other high power stations. Indeed, the function of many high power stations is not only to transmit radio traffic but also to act as a radio laboratory for the testing of new equipment and ideas.

Manufacturer's Tools in Japan

THAT within five or six years the Japanese factory efficiency and skill in machine tool plants will be developed to a point where products will measure up to any turned out by American manufacturers was the view expressed to United States Commercial Attache James F. Abbott at Tokyo recently by an American iron and steel maker of prominence. This expert has spent some time in Japan with the intention of investing and participating in a coöperative enterprise of some sort and has made a thorough study of the manufacturing plants of that country. He believes that the future of American competition in machine tool products is not good for the reason that Japanese plants are gradually getting into a state of efficiency.

On the other hand, however, his investigations show that Japan is extraordinarily deficient in the fundamental field of foundry practice and believes that it will be some time before Japan can become independent of the United States in the way of fabricated materials out of which machines and machine tools are made. This is an interesting point, it is declared, and worthy of being considered seriously by American iron and steel men. Japanese methods in foundry work are reported as being crude and inaccurate and unskilled. Moreover, it is found that in point of castings actually produced, an American at $4.50 a day is more efficient than a Japanese at 40 cents since the former can set up 60 box castings in a day, while the latter with a helper can set up only four. This observation was made at the Kawasaki foundry. It is also stated that the Mitsubishi works at Nagasaki are the most up-to-date and efficient in Japan.



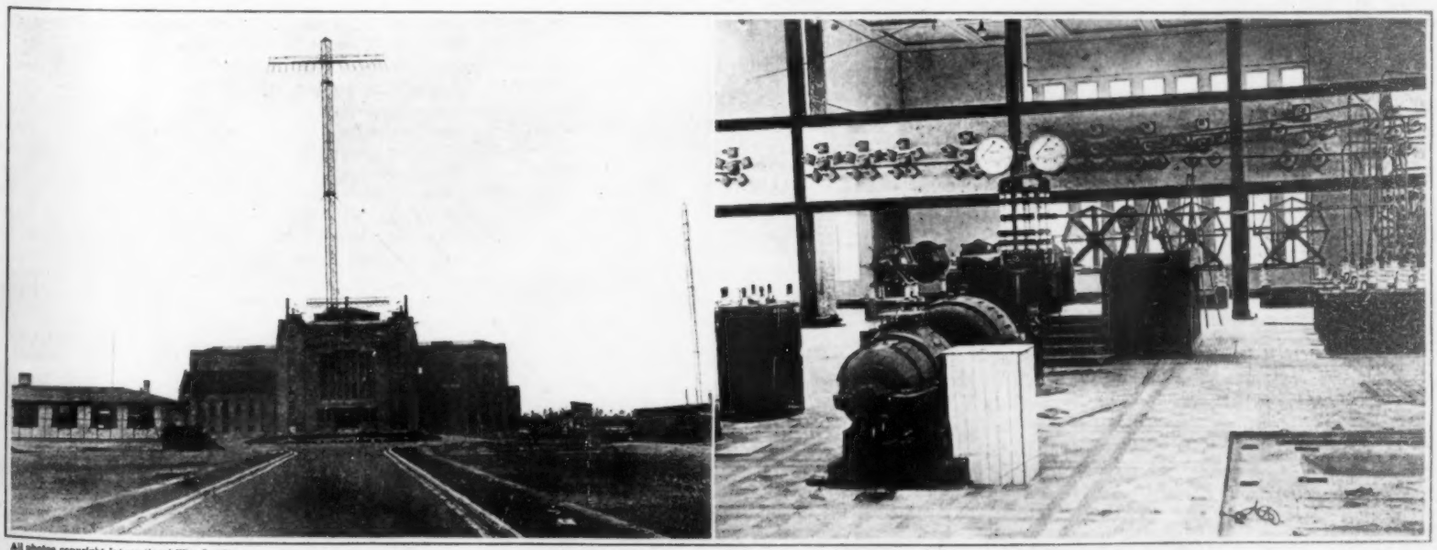
One of the steel masts of the Nauen station, showing the pulleys and weights

Vanishing Forests

IT would seem silly to suggest to a traveller in, say, such a country as New Zealand, that unrestrained deforestation would eventually bring on a famine in wood, yet the word "inexhaustible" cannot safely be used concerning the apparent richness in natural products of any country. This was grimly pointed out at a recent Corporation Conference in Auckland, when a speaker said that those native trees adapted for outside and inside construction could be counted on the fingers of one hand and were vanishing rapidly. An equal number of exotics were flourishing, but reliance must not be placed on these. The main hope was in a properly equipped and well-managed system of cultivated forests. All exportation should be stopped and a £5,000,000 contract with Australia annulled.

A realization of unseemly waste in the past is shown by the floating of the New Zealand Oil and Acid Extraction Company, formed for the purpose of extracting from woods, trees, and sawdust acetic acid, methyl-alcohol, oxalic acid, acetone tar, potash, charcoal, oils and other products. It has been proved that these can all be obtained from the waste products at the sawmills and from the millions of feet of timber put to no reproductive use. The same reckless deforestation was done in Canada until the Government came along and stopped it. The anti-prohibitionists will hug the idea of alcohol from sawdust, but the drinking of wood alcohol was a common practice among furniture polishers some 30 years ago.

It seems curious that a country so reputedly rich in timber as New Zealand should be importing such material, but, during the last five months America has sent over some 45,000 feet of red wood, yellow pine, shingles and laths, chiefly from Oregon.—*D. Waterson.*



Exterior and interior views of the Nauen wireless station which has now resumed peace-time service

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, October 18, 1919
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Important Notice to Our Readers

Owing to the strike which is now in progress in New York City, we are having great difficulty in publishing the Scientific American. We hope to be able to mail the issues for the following two or three weeks, but we beg the indulgence of our readers should they not receive the paper on time, or should it be found impossible to mail the paper until the strike is over.

We may possibly be obliged to suspend temporarily the publication of the Scientific American Supplement.

Is Our Navy in Peril?

A SITUATION has arisen in the United States Navy which, unless it be met and mastered, threatens to undermine its efficiency, and this at the very time when it has reached the highest state of efficiency in its long and honorable history. We refer, of course, to the serious crisis with which the Navy is threatened, if indeed, the crisis has not already come, with regard to its personnel, and by its personnel we refer to both officers and men.

It is well known that the demands of the war resulted in a vast increase, both in the number of ships in commission and under construction, and in the personnel necessary to man them; and it is also known that immediately upon the signing of the armistice steps were taken to put a large number of ships out of commission and gradually reduce the personnel to the requirements of a peace-time basis. So urgent were the appeals of the Reserve force to be permitted to return to civil life, that the pendulum has swung too far, it seems to us, in this direction, with the result that our Navy is already under-manned and promises to be even more badly under-manned in the near future, unless very strenuous steps are taken to stimulate enlistment.

We confess to having been greatly disappointed to find how few of the enlisted men in the Reserves were sufficiently enamored of the naval service, to make it their permanent calling. We had hoped that thousands of these young men would feel the lure of a life upon the sea, particularly when it meant service under the flag in a navy which had won such high distinction in the great world war. Of course, the great majority of the reserves joined the navy in order to help their country in the great emergency, and now that the danger is past, they feel that they are justified in returning to their jobs in civil life. We still believe, however, that the demobilized reserve forces will prove to be a fruitful recruiting ground, when the natural desire to get back to friends and familiar surroundings has been satisfied.

Undoubtedly, the most powerful factor in bringing about the present crisis is the enormously increased cost of living and the greatly enlarged salaries and pay, which is one of the legacies of the war. How seriously this matter is affecting the officers is shown by the fact that, several weeks ago, it was stated that over fifty officers had sent in their resignations and were living in hopes that they would be acted upon favorably. If, as statistics furnished by government officials state, the purchasing power of the dollar has decreased 45 per cent, it will be understood that the question of maintaining themselves on board ship and their families on shore, is a far more serious problem than it was in pre-war days. So far as the men are concerned, it needs no argument to prove that the great increase in the pay of labor which has taken place has rendered life in the navy, judged from an economic standpoint, far less attractive than it was. Take this as a single instance: one of the contracting firms that is building our subways recently informed us that the unskilled laborer, who before the war received $1.75 a day, now receives $4.00; and we know that skilled labor pay has risen from $6.00 to $8.00 a day and upwards.

Now these are the facts and it is for Congress to determine how it will meet the situation. Service in the navy is just as noble a profession as ever it was, and for the enlisted man, at least, it is far more comfortable than it was in the last decade. Something must be done or we must be content to see our navy shrink to a point where the interests and the dignity of the United States will be very seriously imperilled. Battleships are under-manned and we would not dare to state how many of our destroyers and other of the smaller craft are swinging at their moorings or tied up at a dock, with not even sufficient men to give them decent care.

Central Control of the Port of New York

THhe preëminence of the Port of New York, as a gateway of the Commerce of the United States, was decreed by nature when she formed the great natural highway between the western lands and the Atlantic coast by way of the Great Lakes, the Mohawk Valley and the Hudson River. It is to these geographical advantages, indeed, rather than to any careful and far-sighted planning, that New York owes its commanding position; for it cannot be denied that in the matter of railway terminals, docks and loading and unloading facilities, that New York has developed in a very haphazard fashion. No well informed citizen can deny that the port is suffering acutely from neglect—a neglect which is largely due to the fact that jurisdiction over the port is divided between a multiplicity of local officers whose personnel is constantly changing. Never so far as we know, has there been a single voice raised to speak for the entire port. The Merchants Association of this city has long been urging that measures be taken for agreement upon a coherent and adequate plan of port improvement, and for the regulation of the use of the port in such a manner that it shall be made to render its maximum service.

It seems that the States of New York and New Jersey nearly a century ago, made an agreement, or treaty, defining the rights of each in and about New York Harbor and the North River. Several months ago the New York and New Jersey Port and Harbor Development Commission exhumed this treaty, and it has proposed amendment to it, creating an authority representing the two states and clothing it with suitable powers to plan and bring about the improvement of the port; to represent the port before rate-making authorities; and to establish rules and regulations for the use of the harbor. The Port Authority contemplated in this plan, would constitute a continuing body and this factor in itself, would mark a great advance over the existing conditions.

Rivalry between New York and other leading ports on the Atlantic seaboard is more severe than many people understand. Every possible effort is being made to induce shippers to favor these rivals, even in cases where the haul is far longer than it is to New York, and the movement has been attended with marked results. If this attack is to be met and New York is to maintain the premier position to which its natural advantages entitle it, the creation of a single Port Authority representing the two states is an absolutely indispensable condition.

The Great White Plague

WE are told that familiarity breeds contempt, and in the case of that terrible scourge which we call tuberculosis, although familiarity has not bred contempt, it has certainly bred a most dangerous acquiescence. So many are its victims, so constantly do they pass and repass us in the round of our daily life, that many people have come to accept the wide prevalence of this disease as being one of the necessary and ineradicable burdens of life.

As a matter of fact, tuberculosis is not necessary and certainly it is not ineradicable, and in proportion as these two facts are realized, accepted, and acted upon, will the dreaded disease be checked and ultimately controlled, and the toll of its victims be reduced to a reasonable percentage of the population.

We are all agreed as to the harrowing nature of this disease; we all know that it lays its hand upon hundreds of thousands of the population. But it is not so well known that it particularly attacks the producers, chiefly men and women between the ages of sixteen and forty-five, people who are workers—active men and women in the home, the office and the shop. We know that it causes many deaths, but how many of us are aware that in the United States alone, every year, it causes the death of 150,000 people, and that at this very hour over a million persons in this country are suffering from active tuberculosis? To those who reduce everything to a money value, it will be startling to learn that men who have made a special study of this matter, estimate the economic waste of the country through the prevalence of tuberculosis, to be five hundred million dollars annually.

And yet it is a well established fact that tuberculosis is both curable and preventable; for it is spread largely by ignorance, carelessness and neglect.

The National Tuberculosis Association and its one thousand affiliated State and local organizations, are waging a continuous and successful war against this dreadful malady, and the work of these organizations draws its financial support chiefly from the sale of the Red Cross Christmas Seals, a form of philanthropy which should make a quick appeal to every lover of his race and his country.

Is Man a Rational Animal?

A CERTAIN group of economists, of whom Jevons may be taken as the representative, have developed a system based on the fundamental principle that man seeks so to arrange his affairs, his productive activities and his sales and purchases, as to derive maximum amount of pleasure therefrom. Another group, who, perhaps, might be typified by the name of Veblen, insists that this principle is fallacious, that man is not the rational creature assumed by Jevons and his followers, that so far from calculating at every step the profit and loss, the pleasure and pain which will accrue to him from the various courses of action open to him, he is very largely a creature of instinct, and that a very large proportion of his actions are based, not at all on a careful weighing of consequences, but o nwholly non-rational instinct. So, Veblen points out, some men work for the mere love of their work, and if their circumstances permit, they will count neither cost nor profit; while others go on amassing wealth for the love of pomp and show, and not at all from calculating motives which should strike a nice balance of credit and debit in pleasure and pain.

There is probably something to be said for each side in this dispute. The Jevons school retorts that it has by no means overlooked the instincts to which Veblen attaches so much importance. These very instincts determine the pleasure which a man derives from a given course o faction, from the consumption of a given set of economic commodities.

On the other hand it is probably true that unreasoning instinct plays a much greater part in human affairs than is commonly supposed. Psychologists tell us that we have an inveterate habit of deceiving ourselves as to our true motives. The slacker, who is afraid for his skin, pretends high philanthropic motives and calls himself a "conscientious objector"; and we, if we are honest with ourselves, will often find ourselves similarly hiding our true motives under a paint of some more attractive hue. And so, the reasons professed for our actions are often not the true ones; on closer inspection it is commonly found that where we pretend to be guided by reason, we are in truth following the more or less direct promptings of a fundamental instinct.

If our instincts were always opportune, there would perhaps be no disadvantage in non-rational, instinctive action. But man, with all his boasted superiority, is still very far from that state in which either his instincts or his reason are perfect guides. Very aptly Professor Stephen Leacock has drawn attention to the strange spectacle which a human community would present to some disinterested spectator, viewing it, say from another planet.

Astronomy

More Newspaper Astronomy.—The notorious ignorance of the daily newspapers on astronomical subjects, which furnishes endless hilarity to those readers who happen to have some knowledge of astronomy, is delightfully exemplified in a paragraph quoted in *l'Astronomie* from a leading Parisian journal. The writer undertakes to record Prof. Todd's plan of photographing the solar eclipse of May 29 from an airplane, which he describes as a great innoviation in "astrology". The object of using an airplane, says the writer, is to get *nearer to the sun*.

The Apparent Size of the Pleiades.—How do the Pleiades compare in apparent area with the moon? Probably most star-gazers who have not actually made a comparison would say offhand that they are of about the same size, or perhaps that the moon is somewhat larger. An interesting photograph is published in *l'Astronomie* showing an occulation of the Pleiades by the moon. The latter is seen to cover less than half of the area included in the group, and is actually in such a position that Alcyone is seen on one side of it, while the arc of stars including Asterope, Taygeta, etc., is visible on the other side.

Velocities of Nebulæ.—A program for the determination of the radial velocities of the bright-line nebulæ, from observations made at the Lick Observatory and its branch at Santiago, Chile, was completed last year for all known objects of this class bright enough to be observed spectroscopically with exposure times of practicable length. The velocities of 125 nebulæ were determined. In addition to the 18 nebulæ in the Magellanic Clouds, there are six planetary nebulæ whose observed radial velocities exceed 115 kilometers per second. All six are located in a very small area of the sky, and in the southern heavens. The average of the velocities for the remaining 101 nebulæ gives a motion of the solar system with reference to them, as a system, of 23.6 kilometers per second.

Work of the Dominion Astrophysical Observatory.—A recent account by Mr. J. S. Plaskett of the work done at the new Canadian observatory near Victoria, B. C., with its huge reflecting telescope, shows that the attention of the institution has been concentrated on two principal projects. Stellar spectroscopy is the chief work in hand. Spectra of 1,186 stars, on the average fainter than the sixth magnitude, were photographed down to the end of 1918. In the measurement of the plates 30 new spectroscopic binaries were discovered. The spectroscopic observing program, arranged in coöperation with the Mt. Wilson Observatory consists of about 800 stars from Boss's "Preliminary General Catalog," the purpose being to determine the radial velocities of all the stars in the catalog not previously determined and within reach of the two observatories. The other undertaking, begun at the instance of the late Professor Pickering, is to obtain direct photographs of the Harvard regions, with and without a parallel wire grating, for the purpose of extending the magnitude scale in these regions to the faintest possible stars.

The Age of the Sun and Stars.—A recent paper by Mr. Harlow Shapley brings to a focus the long-standing disagreement between physical astronomers and geologists concerning the duration of solar radiation and the consequent age of the earth, and also the question of the age of the stars in general. The short time-scale of the astronomers is based on the assumption that the sun's heat, flowing uniformly at the observed rate in all directions, comes from such recognized sources as gravitational contraction, the fall of meteorites, radioactivity, etc. The supply of heat from these sources could last only a few million years. The data of geology, however, particularly the recent work on rhythms in denudation and sedimentation and on the radioactivity of rocks, are decidedly opposed to a short time-scale for the sun and earth. Mr. Shapley cites a large amount of recent astrophysical evidence in behalf of the belief that the ages of the stars, also, are probably several hundred times as great as was assumed in the older physical astronomy. Obviously existing hypotheses concerning the source of the energy radiated from the sun and stars need revision to bring them into agreement with the evidence in favor of an exceedingly prolonged life for these bodies.

Industrial Efficiency

Wool Grease.—A firm in Melbourne, Australia, is producing a considerable quantity of *adeps lanæ* or wool grease, which is similar to lanoline, and they are prepared to increase their plant and produce unlimited quantities if there is a market for it in the United States. The name and address of the producer may be obtained from the Far Eastern Division of the Department of Commerce, Washington, D. C.

A Modern Coal Plant is to be erected in the harbor of Melbourne, Australia, for the handling of coal, which is to replace the present primitive method of hand-filled baskets which are hoisted out of the steamers' hold by winches. The plant when completed will consist of four electrical hoists with grab buckets, which pick up four or five tons of coal at a time and deliver it to mechanically-operated conveyors, which, in turn, carry it to great storage bins of 30,000 tons capacity, from which the coal is sent in chutes to coal trucks.

Physical Test of Milk Bottles.—Owing to the severe service which milk bottles are called upon to withstand, it is essential that they be constructed of glass possessing unusual strength. A comparative impact test has recently been conducted on such bottles by the Bureau of Standards, Department of Commerce; 47 bottles were used, half of them being made of standard type and the other half of a new type of glass. It was desired that both old and new glass be subjected to the same test in order to discover which was stronger. The results would seem to indicate about the same strength for the new as for the old glass.

Safes and Vaults "Made in Italy."—Announcement has just been made of the formation at Rome, under the auspices of a leading bank, of a large company for the manufacture of safes, vaults, and other equipment for insuring the safety of money, securities, and valuables. This new industry will fill a long-felt want in Italy, which has always been dependent upon foreign sources of supply for safes and similar equipment. It will have the financial and moral support of the principal Italian banking and other institutions and will commence operations under the most favorable conditions.

Our Rice-Milling Industry.—While the rice-milling industry has been steadily growing in the United States, it has treated domestic rice almost exclusively, very little of the foreign product being handled. The growth of this industry seems, therefore, to depend upon the development of the rice-growing industry in the United States. For the immediate future there is slight possibility of milling British Indian rice, owing both to prohibitive legislation and the lack of shipping. It is interesting to note that the amount of uncleaned or brown rice, including "paddy" or rough rice, imported into this country is much larger in amount than the foreign rice milled here, and this leads to the assumption that a considerable portion of this imported rice must be consumed without being subjected to the polishing process.

Standardization of Structural Steel in Australia. A conference which had for its object the standardization in Australia of structural steel sections has just concluded its work at Melbourne. The conference was attended by representatives of the producers and users of structural steel including public departments of the States and the Commonwealth and engineering and architectural institutes throughout Australia. The object of the conference was to bring about changes in the sections to meet the conditions of manufacture in Australia, and also to endeavor to agree upon a reduction in the number of steel parts that users in Australia would demand for makers and thereby reduce the cost by eliminating those for which there is little demand. It is stated that the result of the conference has been satisfactory, and that a series of structural shapes has been defined which will enable Australian manufacturers to meet practically the whole requirements of the Commonwealth. A certain number of sections is to be allocated to each steel rolling mill, which it will manufacture exclusively, and thus be insured a quick turnover on its outlay; and, on the other hand, users will have at their disposal a constant supply of standard sections.

Science

A Medical Foundation for New York City.—A movement is on foot to make New York City one of the greatest centers of medical education in the world, and to this end there has been organized the New York Association for the Advancement of Medical Education. The originator of the project and the first president of the association is Dr. Wendell C. Phillips, ear specialist and general surgeon for Bellevue Hospital, while Dr. Haven Emerson, formerly health commissioner of New York, is secretary. The association aims to provide financially and otherwise for more efficient and more highly specialized instruction in all branches of medicine and more ample facilities for research, utilizing for these purposes the vast clinical material of the city.

A League of Mountaineers and Nature-Lovers.—A note in the *Geographical Review* calls attention to the beneficent activities of the Associated Mountaineering Clubs of North America. When this organization was founded, in 1916, it embraced nine clubs and societies. Now there are 29 and the aggregate membership is over 45,000. Although the clubs in this league are not all devoted to mountaineering, they have a common bond of interest in the preservation of American scenery and in the protection of plant and bird life in their natural environment. The association is coöperating with the National Park Service for the creation and development of national parks and "monuments." A fine collection of literature on mountaineering has been formed by the association at the New York Public Library, and bibliographies are being compiled and published.

Wireless Weather Reports.—A world-wide system of wireless weather reports from and to ships at sea is in course of organization by the British Admiralty with the coöperation of the Meteorological Office. Mariners are asked to send reports of weather conditions regularly at 1 A. M., 7 A. M. and 1 P. M., Greenwich time, to appropriate receiving stations, which will be established in various parts of the world; also reports at other hours, when specially called for. Six or eight stations are being established in the northeastern North Atlantic. Arrangements are also being made for issuing weather bulletins by wireless from 42 stations throughout the world, so that ships will be constantly supplied with the latest weather data and forecasts. This undertaking which is far more ambitious than anything of its kind previously attempted, should prove of great value to aeronautics as well as seamen.

Upper-Air Observations in the United States.—Before the war the United States was conspicuously backward as compared with certain European countries in the establishment of stations for regular observations of the upper air by means of balloons and kites. The development of military aeronautics has changed the situation. The Weather Bureau now maintains kite stations at Brexel, Neb., Broken Arrow, Okla., Ellendale, N. D., Groesbeck, Tex., Leesburg, Ga., and Royal Center, Ind., and has a large Aerological Division at the main office, in Washington, where the upper-air data are assembled and discussed. Similar work has been taken up by the Army and the Navy, in coöperation with the Weather Bureau, and a large number of pilot-balloon stations have been established by these services, so that a system of upper-air observation commensurate with the coming needs of aeronautics is rapidly developing.

Food from the Cat-tail.—Prof. P. W. Claassen, of Cornell University, has recently called attention to a hitherto neglected source of food; viz. the common cat-tail (*Typha*) of our marshes. It appears that the Indians made flour from the rootstalks of the cat-tail, but for some reason white men did not adopt this item of the Indian dietary as they did maize and potatoes. There are thousands of acres of cat-tail marshes in the United States. Prof. Claassen finds that an acre of cat-tail yields a total dry weight of rhizomes amounting to about 10,800 pounds. From this it is possible to obtain 5,500 pounds of flour. This flour is found, on analysis, to contain approximately the same amount of protein as rice and corn flours, but the ash content approximates that found in potato, cassava and dasheen flours. Cat-tail flour has proved very satisfactory as a part substitute for wheat flour in baking and a complete substitute for corn-starch in puddings.

Ironing Out a River Bottom

A Pneumatic Caisson Contract That Brought Up Some Unusual Problems

By J. F. Springer

THE coal deposits of Canada are chiefly those of the extreme west in British Columbia and of the extreme east in the Nova Scotian region. In between, coal is apt to be expensive and the supply more or less subject to interruption. In short, the domestic coal has to be transported over long distances and the imported coal from the United States is conveyed largely by water across the Great Lakes. In the nineteenth century, this might have appeared to limit quite seriously the development of a very large part of the country by hindering the production of power. But the handicap does not appear quite so serious today; a vast difference is made by the industrial developments of the twentieth century.

Among the most important of these are the perfecting of the hydraulic turbine and the advance in the long-distance transmission of heavy electric currents. The modern turbine wheels with their high efficiency enable us to take advantage of both high and low drops in the levels of streams. An abundance of water and a low fall constitute a combination as adequate as less water and a bigger drop. Of this the Mississippi Power Company's hydroelectric power development at Keokuk, Ia., which utilizes a very moderate difference in level of the Mississippi River, is a shining example. The great volume of water makes up for the lack of a high head. Long transmissions are common on the Pacific coast and make available at such centers of population as San Francisco and Los Angeles the water powers located back in the mountains. In addition to the foregoing principal considerations facilitating the utilization of the mechanical movement of streams, may be cited such minor ones as the development of concrete engineering and the big advance in the metallurgy of aluminum.

IN many parts of the United States as well as in most of Canada it is going to be more and more out of the question to consider the use of coal in the generation of power. The hydroelectric development, Nature's source of white coal, is the only substitute we have for the rapidly diminishing stores of black coal. But the hydroelectric development involves problems in engineering construction of great magnitude and extreme interest. The present account of what the men in charge of one Canadian project had to meet is typical and thoroughly timely.

We were speaking of Canada. Nickel mining interests in northern Ontario naturally turn to water power as a substitute for steam power. In fact, the Canadians generally show signs of a realization that while Nature has withheld coal, she has nevertheless rather generously scattered water-power sites around. The nickel people have an already existent hydroelectric development which furnishes electric current to their plant at Copper Cliff on the Canadian Pacific Railway. They are extending the development by increasing the storage capacity at a point on the Spanish River, twenty-five miles from Copper Cliff, where the stream makes a very sharp bend. That is to say, the selected point on the river marks the position of a long 1,000-foot dam whose purpose is to impound water for 20 miles back of it. The enterprise includes the construction of a part of the dam in the river gorge at this location.

Now hydroelectric developments are no longer novelties themselves; but it often happens that the site and other conditions impose problems which require solutions of an unusual character. This is the case here at the Big Eddy Dam. The Spanish River at this point is narrow but deep. The problem presented was how to construct the substructure of the dam. It was at first proposed to sink reinforced concrete caissons along the upstream and downstream boundaries of the foundation, and then, after laying bare the intervening region, to fill it in. The caissons would thus become coffer-dams for the period of construction and later would form part of the dam itself.

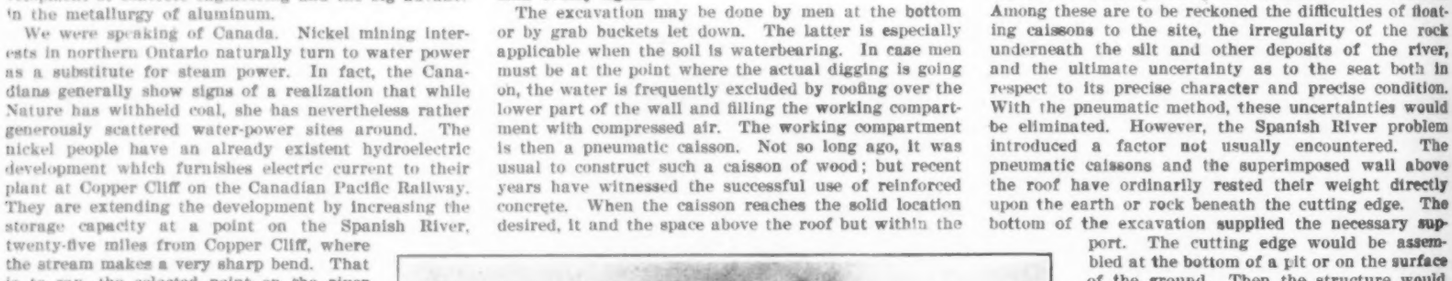
An ordinary open caisson (or well) is a common means of sinking a shaft on land. A ring of stone, brick or concrete masonry is constructed on the surface or at the bottom of a pit. By excavating the soil and rock under and within the ring and simultaneously building the rig higher, the wall sinks gradually and at the same time provides against the caving in of the sides of the shaft as it deepens. A good deal of care is required to prevent such a structure from losing exact verticalness and thereby becoming stuck. When such an accident occurs, it is sometimes possible to correct what is wrong and get the unwieldy affair to sink evenly again.

The excavation may be done by men at the bottom or by grab buckets let down. The latter is especially applicable when the soil is waterbearing. In case men must be at the point where the actual digging is going on, the water is frequently excluded by roofing over the lower part of the wall and filling the working compartment with compressed air. The working compartment is then a pneumatic caisson. Not so long ago, it was usual to construct such a caisson of wood; but recent years have witnessed the successful use of reinforced concrete. When the caisson reaches the solid location desired, it and the space above the roof but within the wall may be filled with concrete or other suitable material. The whole then constitutes a pier suitable for foundation purposes.

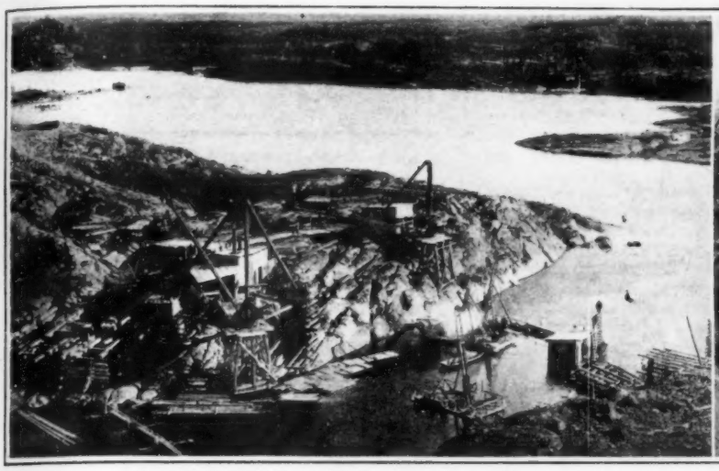
Something of a similar character to the open caisson or well has been used in providing subaqueous foundations. That is, a solid or hollow wall would be built up on a wooden substructure causing the latter to sink. Or, a caisson of concrete, open at top and closed at bottom, would be floated to the site and sunk by filling in and building up. But those methods imply a level seat beneath the water or a seat that admits of being made level. There is likely to be more or less uncertainty as to the condition and character of the seat since at no time do the workmen or the engineers get into actual, unobstructed contact with it. Where divers and borings make clear that there is a natural level seat of solid bedrock or that the lack of horizontalness of an otherwise fine site can readily be corrected, or where the character of the structure to be erected permits a degree of imperfection in the foundations, the methods described may properly be used. A dam, however, requires a very high degree of perfection in the foundation, particularly at the point where it rests upon the natural rock.

At the Spanish River site, it was decided to abandon the idea of launching and floating the open caisson, and to employ instead the pneumatic caisson, having a roof on top and being open at the bottom. Compressed air would exclude the water and nevertheless permit workmen to get to the points of excavation. This is the pneumatic method by which so many piers have been sunk in lower New York city. It was adopted for the Spanish River work probably for a number of reasons. Among these are to be reckoned the difficulties of floating caissons to the site, the irregularity of the rock underneath the silt and other deposits of the river, and the ultimate uncertainty as to the seat both in respect to its precise character and precise condition. With the pneumatic method, these uncertainties would be eliminated. However, the Spanish River problem introduced a factor not usually encountered. The pneumatic caissons and the superimposed wall above the roof have ordinarily rested their weight directly upon the earth or rock beneath the cutting edge. The bottom of the excavation supplied the necessary support. The cutting edge would be assembled at the bottom of a pit or on the surface of the ground. Then the structure would be built up on the cutting edge. In the case of the Big Eddy Dam, there was a very serious difficulty in the way of providing such support. The start had to be made under water upon an irregular surface.

It was decided to construct wooden trusses which would extend over the water covering the site and thus provide support for vertical rods. The cutting edge and other necessary construction above it would



Top: **Shooting out the upper flume cofferdam.** *Left:* **Penstock section.** *Right:* **The caisson during high water**



A panorama of the operations from the northwest

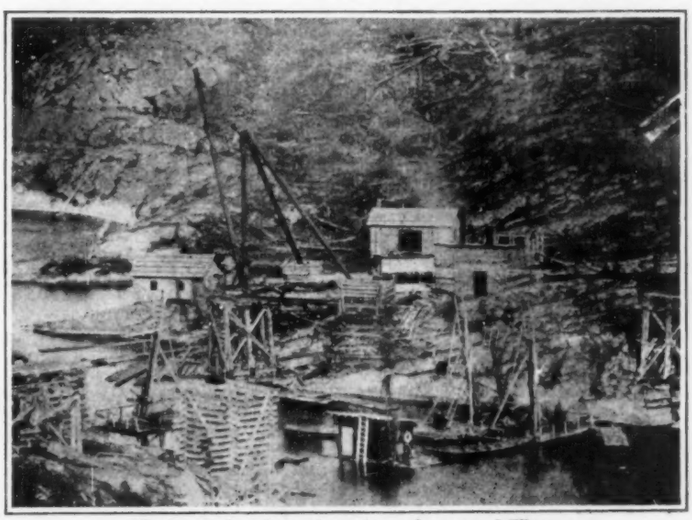
General views of half-completed Big Eddy dam as seen from the west upstream bank

be carried by these rods. Construction could thus be begun above water. Further by lengthening the rods under strict control, the structure could be let down into the water, compressed air put on, and access given to workmen to excavate the material between the cutting edge and the final seat. However, the trusses themselves had to have support and the management of the lengthening of the rods must be freed from uncertainties.

The means provided for supporting the trusses were piles temporarily set up on the bottom of the river, upstream and downstream of the site where the caisson was to rest. Pile trestle-bents were, in fact, provided and on these the ends of the trusses were supported. The trusses were thus arranged lengthwise with the current.

Four principal caissons have been sunk to bedrock. Two of these are located so as to have their upstream faces correspond with the upstream face of the dam. And the other two were similarly placed to conform to the downstream face.

Groups of six piles each were arranged on shore to form bents. These were hoisted and swung into place by derricks standing on the river banks. The bents were not driven into the bottom, but were stood in place and held to position by bags of concrete. These were placed by divers. The correct heights for the various bents were predetermined by soundings. These pile bents were, in fact, not pile structures at all but actual, temporary piers. The distinction is not always realized, though it is very important. A pile derives its supporting power from the resistance of the surrounding material exerted upon its sides, as well as from the resistance to the further penetration exerted against its foot. The moment the sides play no part, the pile becomes a pier and may need protection against buckling. The positions of the various bents were indicated by means of a wooden float or raft of the size and shape of a plan section of the caisson. This raft would be floated into the place the caisson was expected to occupy and the bents set.



Rafts employed as a base for underwater drilling

The Spanish River is quite narrow at this point; so that the caisson and nearby positions were within reach of the 50- and 60-foot booms of the derricks. The natural current was about 4 miles per hour; but during the construction work of the dam at this point the velocity rose to double that amount because of the obstruction occasioned by the operations. Naturally, such a swift current materially increased the difficulties. The caissons have such various lengths as 20, 35 and 40 feet, so that, when two or three were in place and also the temporary pile bents for the one or ones actually being constructed, it is not difficult to see that the channel was much reduced and obstructed. The water got past by increasing its velocity.

The rods used for suspending the caissons and the platforms immediately supporting them were 2 inches in diameter and 31 feet in length. The rods were threaded so as to provide for letting them out. The cutting edge, made up of plates and angle and channel bars, was assembled on the skeleton platform. It was a foot in height; it provided above for the concrete wall and supplied underneath a proper edge for penetration into the soil and rock. The caisson was divided into the working chamber below and a high coffer for the rest of the way up. The roof of the one was the floor of the other. The sides of the working chamber were increased in thickness with the height above the cutting edge, a stepped construction providing for this. Naturally, forms were built up to hold the plastic concrete. These forms were heavy affairs. Thus, the outside one for the first course was constructed of 2-inch planking and this was nailed to 3-inch transverse pieces. Above the roof of the working chamber, the caisson was constructed in the form of cells. These were formed by vertical walls standing about 6 feet apart in the clear and which extended both lengthwise and transversely. Collapsible forms were employed for these walls.

Concrete was poured, a course at a time. When a lower course had sufficiently hardened, the form would be stripped at this point and extended above. The lowering of the caisson went on at intervals, and was naturally made to conform to the progress with the concrete.

There were about 28 rods for a maximum-sized caisson. Channel saddles were provided for the lower ends of the rods, the saddles being embedded in the concrete. The rods were provided with brass nuts above. These rested on steel plates. By turning the nut, the rod could be lengthened below. This was done by two men with a long-handled wrench, lubricating oil being used to facilitate the movements. Friction occurred between the threads of nut and rod, and between nut and plate. Both contacts consisted of two metals, steel and brass. This difference in metal undoubtedly facilitated the adjustment of the length, brass and steel being especially suited to provide surfaces, adapted by their metallic characteristics to reduce the friction of a sliding contact under pressure.

The temporary seats of the caissons on the bottom of the river were prepared in advance of the cutting edges reaching them. It will easily be understood that, even so, the bearing would probably be incomplete. And so it turned out. It seems that there were cases where the edge would have a fair contact with the material of the bottom at various locations in its circuit, but no contact at all at other locations. The skeleton platform accordingly provided support for the men who would be sent into the working chamber to drill and blast the rock.

The caissons could have been relied on to provide a certain amount of compressed air automatically, after the manner of a diving bell. But such dependence would not result in a working chamber fully cleared of water, for the reason that the water pressure would compress to some extent the air trapped in the compartment.

Compressed air was turned on for use in the caissons on December 15, 1918, and was continued until May 17, 1919. After the caissons got firm seats in the rock underneath the river, the procedure with the caissons was essentially similar to that used on land in such work as sinking the pneumatic piers of the Singer Tower and the Woolworth Building on lower Broadway, New York.

Carbon Contact Bows for Electric Vehicles

WHEN copper became scarce in Germany during the war, the contact bows for aerial railway were replaced by aluminum, which had already been used for this purpose before the war. Aluminum, however, in turn became unattainable; thus zinc came into use, but it did not answer particularly well. At the Immigrats plant of the Rhenish-Westphalian Electricity Works experiments were then made with contact pieces of carbon. At first the wear was 1 gram of carbon per 10 car-kilometers; that figure was soon improved upon, however, and the wear went down to 1 gram per 67 car-kilometers. The zinc bows did not last more than 8,600 car-kilometers, and the average for aluminum was 11,000 car-kilometers, according to D. Strojohann in a German technical paper; by autumn, 1918, some of the carbon bows had reached a life of 110,000 car-kilometers, the average being 75,000 car-kilometers. The carbon was first greased, but that was found to be unnecessary. The bows have a length of about 1 meter and as made by C. Conradty, of Nürnberg, they are built up of sections of carbon. The whole is mounted on a flat strip of steel plate, which is turned up on both sides so as to grip the carbon pieces; bars of cast-iron are interposed between the carbon and the steel edges so as to secure good contact. In cross section the carbon is not solid, and a tension device, adjustable by means of screws, is fitted into the hollow to press the carbon against the holder. There is less sparking than with aluminum bows, and worn-down carbon sections can be renewed so that the carbon of the whole length of the bow is utilized.

Some Industrial Uses of the Potato

Process Familiar to Europe, But with Which Uncle Sam is Not on Speaking Terms

By J. Paul Heritage

IT is related that when the Spaniards discovered gold in the land of Incas, the story resounded throughout Europe. A mistaken economic theory held for a long period that the mere possession by a country of precious metals was an index of prosperity.

Our colonial settlers expected to raise grapes and export wines in abundance. But they found certain pests which made a living by this method precarious. They found however three plants which have been of profound interest to the world. They are tobacco, corn and the potato. The first saved their lives by giving them a basis of trade with Europe. Corn gave us a plant which has in many ways become our most important. The potato has been transplanted in Europe and has given that continent what is commonly regarded as its most important food product and the basis of considerable industry.

Our chief, and practically our only, interest in the potato today is as a vegetable for the table. We are greatly surpassed in this use by Europe, and Germany in particular. In that land the average annual per capita consumption was seven bushels in normal times while our own was two and a half. The laborers of eastern Germany ate seventeen bushels per annum. The other European countries are as a rule far above us and the diet of many an Irishman is said to be potatoes and spring water—for breakfast, dinner and supper. In addition to this direct consumption, uses of the potato largely unknown to Uncle Sam are for flour, starch, dextrine, glucose and alcohol.

Potato Flour

Before the war most of the potato flour was used solely for cake and pastry. War demand brought attention to other uses, such as bread. It was found that quantities of potatoes could be mixed with the potato flour with wheat was even more acceptable. The Netherlands has had a very large development of this product under a coöperative scheme. Some was sold here as a substitute for wheat during the war, but its high price (about sixteen cents a pound) prevented a heavy demand. This flour came largely from Japan.

The two German dried products are called "schnitzel" and "flocken." The former is made by shredding the raw potato into pieces about as thick as a pencil and then drying them under an intense heat. This material is usually fed to cattle. The "flocken" or flakes, are made by first cooking the potato by steaming and then mashing and drying by passing between hot rollers, by steam power. As the rollers are close together the mass passes through them like a sheet of paper or like clothes through a wringer. The mass is thus completely dried and is a yellowish-white residue, which forms a coarse sort of potato meal. This is used as flour or mashed potatoes. Sometimes the potatoes are sliced but not peeled and the pieces after washing and drying are run through a bolt cloth. The skins, corresponding to the bran of wheat, are left behind. Some manufacturers however emphasize that peeling should be done first.

A strong argument is made for the use of potato flour on the basis of health. Dr. Harvey W. Wiley says: "I believe the wholesomeness of white wheat bread would be greatly increased by the addition of a considerable amount of real potato flour. The reason for this is that the potato on oxidation in the body produces an alkaline ash while white flour on oxidation produces an acid ash favoring the production of acidosis." The State of Michigan has had experts studying the situation, particularly with regard to the possibility of the use of beet and chicory driers for the drying of potatoes. The report also touches the matter of health and emphasizes that an alkaline condition of the blood is desirable for good health and disease resistance. Meats and cereals acidify. Summing it up the report rather eloquently says: "If the consumption of potatoes in this country could be quadrupled the result would undoubtedly be the saving of many thousands of lives annually and are incalculable amount of suffering and disease."

The Problems of Drying and Marketing

The industry would be facilitated in our northern potato States if the beet and chicory driers could be used. Letters addressed by the different manufacturers to the Public Domain Commissioner showed that a majority favored the use of the driers and said there were no serious reasons why they could not be used. One told of the use of forty per cent potato bread by Chicago bakers. One or two were discouraged and had given up the job of educating the public to the merits of their wares. Mr. Charles Whitney tells of successful work in Canada, where however the principal customer was the British Government.

The *Rural New Yorker* was quoted in the Michigan report and contributed a glowing account of the commercial side. It appeals for a larger use of potato flour and says: "The most advantageous use of potatoes at the present time is unquestionably the manufacture of potato flour." It adds: "People accustomed to its use will no doubt pay a good price for it. Anyone starting an industry of that kind can be sure to make it pay big." Mr. T. C. Johnson of the Virginia Experiment Station thinks a potato flour factory would be a good thing for the farmers of his section.

While some of the reports seem to be somewhat pyrotechnical, four facts stand out: Potato flour is probably beneficial to the health; it can be manufactured from unsalable potatoes; driers now in use could manufacture it; and the dried article would be better to ship as one would not have to pay freight on water or on an article that might spoil in transit.

A sufficient supply of tubers would have to be had to supply the market and at least keep the driers busy for a season. Of course sentiment for the new flour would have to be created by national advertising. The Food Administration found that people would almost fight before they would change their diet. Yet many foods and drinks which would have had practically no sale have been successfully marketed on account of heavy and clever advertising.

THE chief interest of America today in the potato—practically our only interest, in fact—is as a table vegetable. In this respect we are far behind the European nations, especially those of the continent. Germany, for instance, uses each year four times as many spuds per capita as the United States. This does not mean that Michel eats all these tubers, but that he makes them over into starch and alcohol, that he gets flour and feed from them, that in general he uses them for all they are worth while we do not even attempt to do so. In this paper Mr. Heritage discusses the theoretic and practical possibilities of better utilization, in America, of the potato's manifold resources.

As cattle feed, potatoes are much used. They are fed here to some extent in the raw state, but are said to be a healthier product when cooked. Their use in Europe usually depends on this operation. They are frequently dried. Hogs eat nearly forty per cent of the big German crop. The dried potato industry has shown phenomenal growth in that country. In 1907 for instance there were 118 factories, while in four years the number had increased to 404. The practice originated from the idea of drying beets after the sugar had been extracted.

Most of the Germans refuse to quote pirces on their plants for general information. One handling five tons a day of twenty-four hours would cost at pre-war prices about $1,650. A seventy-ton plant would cost but three times as much. The drying process has been considered under flour.

The need of cattle feed in this country is probably much less than in the north European countries. We have plenty of fodder and much land to grow it on. We have corn and they do not. We might not go into drying to develop it, but we might engage in it as a possible outlet for overproduction. It would also serve to keep as a source of future consumption the small potatoes which are now often wasted. The present high price of feed might serve as an opening wedge for the development of more of an industry than is at present anticipated.

Another cattle food is slop, the residue from the manufacture of alcohol. Some of the most valuable parts of the potato are left in the mash. It is not quite so good as grain slop as it contains more ash and less fat. The Germans feed eighteen to twenty gallons daily to oxen and somewhat less to milch cows. The mixture is generally fed hot and fresh, but will keep if thickened and dried. The dry mash is frequently marked as cakes and sold. Its nutritive value is very high. At present unfortunately the manufacture of these is too expensive. The possibility of the use of the slop residue is dependent upon how far we go into the manufacture of potato alcohol.

Sources of Starch

There is considerable potato starch manufactured in Europe. There has been some development along this line in our country. Maine is the leading State. There are forty-nine factories in this State and only eleven in the remainder of the country, according to recent report. Aroostook, the great potato county of Maine, is the farthest north and is or was quite inaccessible, particularly from our own land. Consequently this section, now famed for potatoes for seed, did not at first thrive until a Vermont Yankee found that six tons of potatoes could be squeezed into one of starch, whereby a lighter and more valuable load could be sent out.

As to the future of this industry there is little encouragement. Commissioner Guptill says: "The future of starch factories is not especially bright, any more than has been the past. It depends entirely upon the price of potatoes whether they are made into starch or not. When potatoes sell for twenty-five cents a barrel or less, every factory is running full tilt." The Wisconsin Experiment Station paints no brighter picture. In that State the few factories have only run three or four out of the last fifteen years.

Of course it should be emphasized that we have not a great surplus like the Europeans and there is no development here of the high starch-yielding varieties. There is a good market for the product in the textile industries. Here it is used for sizing (binding the loose threads of the fabric). The print makers are willing to pay much more for the potato product than for corn starch. So much more valuable is the potato that it is alleged adulteration is practiced. Potato starch is probably not used in home and laundry for the reason that it will bring more elsewhere. If it could be manufactured more cheaply, as it must with larger amounts of culls assured yearly or nearly so, it might become a competitor of starch manufactured from corn and rice.

We import about 10,000,000 pounds ordinarily—about half the amount we produce. This we might easily have made. It has also been suggested that the drying of the culls on the farm and their manufacture into starch at one's convenience is feasible. A protective tariff of one per cent has apparently not got this industry out of the infant class.

The manufacture is not a complicated proces, the drying being somewhat more painstaking. The tubers are first cleaned, then ground. This sets the granules of starch free. The ground mass is then washed with cold water and the starch settles at the bottom. This is collected into vats, spread out on shelves and artificially heated. It dries into lumps and is then the commercial starch. The residue from this manufacture is, like alcohol, a valuable cattle food. It may also be used as fertilizer. With characteristic wastefulness we in this country have thrown it away.

Dextrine and glucose should not be omitted. The Department of Agriculture is experimenting in the use of these products as well as ensilage composed of potatoes. We imported over 4,000,000 pounds of dextrine in 1910 and this in itself would make quite an industry. Dextrine is simply roasted starch. It is used in the textile factories as a thickener or vehicle for applying the colors to the fabric. It is also used for mucilage. Germany leads in this industry and the Netherlands has a notable development. Glucose is the syrup secured from potato flour. This material is used in the confectionary shops where it is desired for candy, cakes and preserved fruits.

Minor uses of the potato are for yeast and for a culture medium for use by physicians and chemists. An unusual use in Ireland is as soup which is made and preserved. Such a use might easily become in greater vogue because of the growing popularity of canned goods.

(Continued on page 398

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Daylight Saving

To the Editor of the SCIENTIFIC AMERICAN:

If you will try it out personally, observing the hours that govern the city clerk or laboring man, I believe you will decide that God knows more about time than President Wilson does. C. W. BROWNE.

Kansas City.

To the Editor of the SCIENTIFIC AMERICAN:

Why not drop the farmer's woes for a moment and consider those of the seven-o'clock worker? He requires on the average at least thirty minutes to get to work. He must leave home by 6:30, which means 5:30 by sun time; accordingly for by far the greater part of the summer he must breakfast by artificial light. Worse; whoever gets his breakfast and packs his dinner pail must be up by 4:00 or 4:30, sun time. In the face of this, if eight hours' sleep are to be had, these people must be in bed while it is still broad daylight for a good part of the season. There are plenty of seven-o'clock workers, in spite of the eight-hour day; there will always be seven-o'clock workers preparing the way for the eight- and nine-o'clock arrivals, taking them to work, etc. Surely this class added to that of the farmer would give the majority against daylight saving. E.J. HUTCHINSON.

Hampton, Va.

To the Editor of the SCIENTIFIC AMERICAN:

The thing about the daylight controversy that strikes me most forcibly is the claim that the farmer is not sincere in his protest that he cannot work when the dew is in the fields. I have many acquaintances who get great enjoyment out of the early evening game of golf which the retarded clock permits them. I have asked these gentlemen why they cannot leave business an hour earlier and get in the same time on the links, and the very reasonable reply is that they must accommodate their business hours to the general custom. Then I ask them why the do not, in that event, get up early in the morning and play before going to business, and the very unreasonable reply is given, with an expression of horror, that one can't play a decent game of golf with the grass soaking wet. Yet when the farmer makes a similar claim he is profiteering!

C C.

New York.

To the Editor of the SCIENTIFIC AMERICAN:

Occasionally one hears of cities that have staggered hours of opening business for the establishments in different lines of work. One group goes to work at six, another at 6:30, etc. Now if this works out to the worker's satisfaction—and I assume it does or it would not be done—it would seem to be evidence that everybody can start work an hour earlier without tinkering with the clock. All that would be required would be getting used to it.

In the country the farmer rises according to the urgency of the work and the light provided him to work by. The city worker could do the same no matter what the clocks said. Save daylight by all means, but go about it right. Don't try to sugar-coat the bitter pill of early rising by manipulating the clock, but just start in an hour or two sooner.

C. EMRICH.

Buchanan, Ia.

To the Editor of the SCIENTIFIC AMERICAN:

Your editorials on daylight saving seem reasonable enough, yet I remain unconvinced. Cannot city people or at least suburbanites rise early and work in their gardens or even take a joy ride before breakfast?

Farmers are compelled to adjust themselves to nature. They are not guilty of wasting daylight. In rural districts the villagers have so adjusted their hours that the farmers can come to town and spend their money in the evening. Hence towns have been led to establish late hours.

It should appeal to a scientific man that telling the truth about the time is to be encouraged. With a common basis of time we can work out a better adjustment by stirring up those who have been wasting the morning hours. The United States is after all an agricultural country, and it is worse than useless to crowd farmers into threshing out of the shock when the dew is on. Let us all pull together in peace as in war. HECTOR MAIBEN.

Palmyra, Wash.

To the Editor of the SCIENTIFIC AMERICAN:

My objection is to the necessity of changing the clock in order to bring about early rising. We all know, as you say, that no daylight can be created. The farmer can easily utilize the sunlight on both sides of the noon hour, but the other man finds his recreation hours divided between morning and evening. So in order to combine them he sleeps mornings and retires later at night. While we are deciding the question, why not kill two birds with one stone and consider our health as well as daylight saving? Are we not able to do what our ancestors did by getting up early without juggling the clock to deceive ourselves?

What we want is some arrangement whereby people who want daylight saving may have it, while those who do not want it may leave it alone, and people who do not benefit would be able to take it or leave it. As the thing is run under the daylight saving plan of 1918 and 1919, the city dweller wants all the benefit without any of the inconveniences. If he must have a long, light evening, let him pay for it himself by getting up earlier and getting his work done earlier; it can be done that way. Some of the railroad men here make up their eight-hour day by working from 7 A. M. to 4 P. M. This illustrates my point to a nicety—why is it not feasible to go to work an hour earlier, if you want to, without changing the clock?

Penn Yan, N. Y. G. W. ANGUS.

FROM time to time we have received from readers expressions of opinion with regard to daylight saving. Space has heretofore been lacking to print these; and we have been living in hope that enough of our subscribers would support daylight saving to make the thing more of a discussion and less of a love feast. However, practically all of our readers who were sufficiently interested to express an opinion are of the one mind. In a way, the matter has been disposed of by the passage of the repealer over the presidential veto; but we anticipate there is still interest in the merits of the question. Accordingly we present the accompanying expressions.—THE EDITOR.

To the Editor of the SCIENTIFIC AMERICAN:

Would it not be a good idea, if we are to have all this fuss about time, to make a change along the following lines:

At present, when it is five o'clock in New York it is two o'clock in San Francisco, and three o'clock or four o'clock in intermediate places. This makes necessary a good deal of translation from the time of one zone to that of another, and is in many ways a great nuisance. The traveller on entering Pittsburgh is never sure whether given clock is registering Eastern or Central time; he has to change his own timepiece en route, etc.

The success which the daylight-saving plan has met in some quarters and the suggestions that we should shift our working day without shifting the clock, both would indicate that it really does not make much difference what we call a given hour, it is the degree of light obtaining at that hour which counts. Why not have a single time system for the entire country, so that when the clock says one o'clock in one place it is one o'clock everywhere. That would greatly simplify all things having to do with intercourse between the sections of the country. Then all that would be necessary to adjust the working day to the daylight hours would be for the various states or municipalities to pass laws setting legal noon at, say 10 o'clock in the extreme east and 1:30 in the extreme west. This particular choice of figures assumes that the national time is that of the sun in the extreme westerly section of the present Central Time-zone. Under a different arrangement the hours of legal noon would be different; but the main point would be to have it come in the middle of the working day, or, if a given locality wanted it so, in some other part. All problems of daylight saving would then be automatically disposed of.

P. G. J.

Cincinnati.

To the Editor of the SCIENTIFIC AMERICAN:

Personally I am not affected in the least, and would not be opposed to daylight saving if it benefited anybody. But in the present form it is unscientific, unjust and undemocratic; for it could just as well be realized by those who would be benefited, without forcing it on those who are harmed by it.

Why not let each community, each mill and factory, each mine and railroad, decide upon its own daylight-saving problems? Why not put it to the vote of the workers in each industrial unit every spring, and if they decide in favor of daylight saving, just advance their working day an hour and leave the clock alone?

Is the city man so far degenerated in moral fiber that he has to fool himself out of bed a little earlier by playing a trick on the clock? On that basis the farmers might well ask for a law moving the clock ahead three hours to make them believe it is seven o'clock when raelly it is only four; for the latter is the hour at which most of them start work in the summer.

As far as any saving is concerned, the whole thing is pure humbug. Do you know how the city man spends his extra hour in the evening? He cranks up his car and goes out into the country for a spin. Now I understand that the gasoline resources are in a good deal worse shape than the coal; so in my opinion it should be saved first. Of course I don't mean to imply that I am opposed to automobiling; I simply want to point out that the alleged saving is a fraud because it leads to a spending in another direction which we can even less afford. E. DAHBEL.

Osier, Mich.

To the Editor of the SCIENTIFIC AMERICAN:

Your apparent unfamiliarity with some of the conditions on the farm causes you to overlook several points which favor the farmer in his opposition to daylight saving. It is not merely that he can't work effectively when the dew is on the ground. Even with normal time, during the spring work and after September 1st the farmer works for an hour or more by lantern light; and if he avails himself of daylight saving he gets nothing but still another hour of groping about in the darkness.

Of late years the automobile has put the farmer in a position where he can attend the evening amusements in the nearby towns without breaking into his day's work. This is a powerful factor in the back-to-the-land movement. But when he cannot start work until an hour after his normal schedule calls for the day's labors to begin, he is an hour later in finishing a fair day's stint, regardless of the hour at which his independent hands quit. He himself is not so independent. The attractions in town, however, with few exceptions begin at the same old hour, *by the clock*. It is not very cheerful to arrive at the amusement center just in time to meet the crowd going back. In order to help out the recreation schedule of the eight-hour worker the fourteen-hour worker is robbed of all recreation!

Do not forget that the farmer is unable to ignore the daylight saving. In dairy localities he must meet the early morning train with his milk, and this train *must* run on the advanced time, or it will not get the milk to the city in time for the workers' breakfasts. It is idle to say that you don't get today's milk for breakfast; perhaps you don't in the biggest cities like New York, but in thousands of smaller communities you do.

Doubtless the reluctance of the hired men to work late would lessen with a continuance of daylight saving. But in this vicinity we find a distinctly unfavorable effect on their morals by working an hour later in the evening, even though they know that they start that much later in the morning.

As to the saving in coal, is that to be weighed against the happiness and contentment of millions of rural workers? Farmers willingly submitted to daylight saving in 1918, because it aided the one great issue of winning the war. Now that peace has come, we will not longer endure the many exasperating inconveniences of the to-some-extent-daylight-saving plan.

M. C.

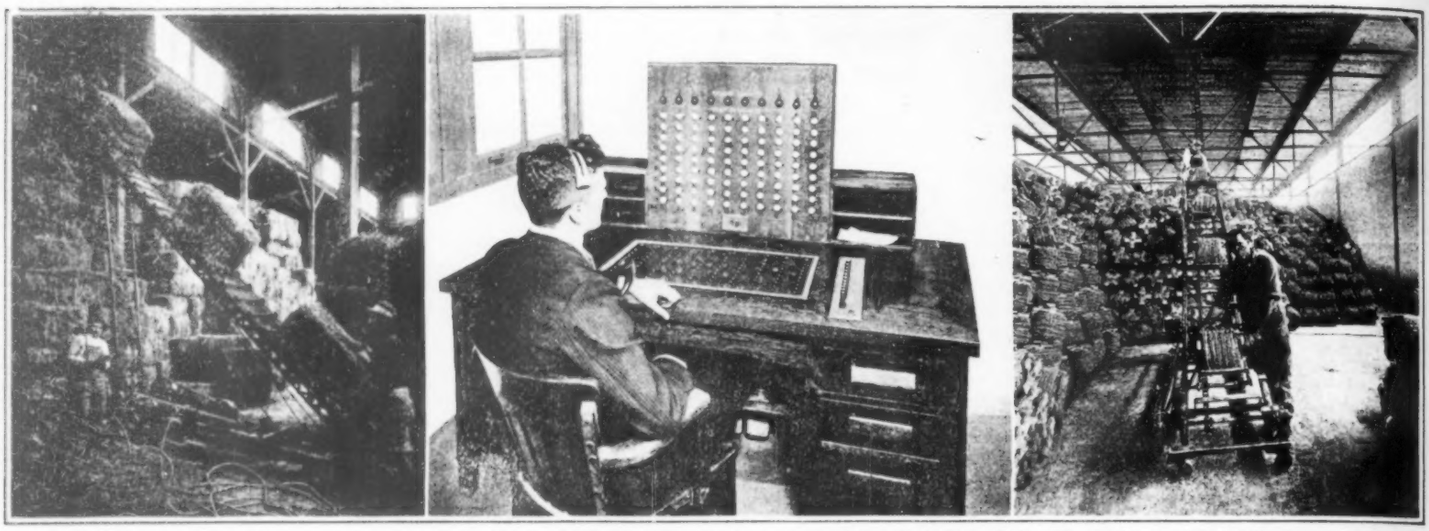
Jamestown, N. D.

The Minority Speaks!

To the Editor of the SCIENTIFIC AMERICAN:

Trust you will not stand by and see daylight savings repealed without putting up a fight. I do not know of a single person who would like to see us back on the old basis. It is the most beneficial measure for the working people ever enacted. A. M. CULVER.

Los Angeles.



Left: Stacking baled hay with conveyors. *Center:* The switch board from which ten elevators are operated by a single man. *Right:* The portable conveyor handling spools of wire

Scenes in the great Brooklyn supply base

The Modern Terminal

Where the Conveyor Belt Conspires with the Automatic Elevator to Reduce Handling Costs and Save Time

RISING in impressive magnitude on the waterfront of New York Bay, constructed under the stress and secrecy of war, is the world's greatest single terminal and distributing plant. It is known as the United States Army Supply Base, Brooklyn, and it is the largest of the great receiving and distributing bases built by the Government in connection with the late unpleasantness. It embraces about 100 acres of land, over 15 miles of railroad tracks with storage for 1,300 freight cars, and 8,000 feet of stringpiece available for the simultaneous loading of a dozen ocean carriers. The warehouse floors contain four million square feet of space, and the transfer sheds add a million and a quarter to this. In this 116 acres of floor space there can be handled, on a 30-day turnover basis, 15,000 carloads of freight, or from 300,000 to 400,000 tons.

To effect all this in these times of labor shortage requires the utmost utilization of devices for decreasing the manual handling of goods. Indeed, in the Brooklyn Supply Base the mechanical installations for expediting the handling of freight are so much the feature of the place that it is to them, rather than to the gigantic size of the establishment, that one instinctively turns in writing the story of what has been done here. The utmost practicable utilization has been made of cranes and derricks, lifting trucks for picking up whole loads with one operation, trailer trucks, and both gravity roller-conveyors and others of the portable power-driven type. It is an old warehouse maxim to "keep the goods moving," but a fundamental feature of the huge Brooklyn plant is not only to keep them moving, but to keep them awheel.

The Industrial Trackless Train

In this ultra-modern development everything is handled on four-wheeled trailer-trucks. Goods that are carried across the country by trainload are carried across the floor of the warehouse also by trainload. The trailers are moved horizontally by industrial plant tractors of the sort which have from time to time been shown on the pages of the SCIENTIFIC AMERICAN under such captions as the one that heads this paragraph. They are moved vertically—the loaded trailers, that is—by one of the most interesting elevator systems ever installed. Goods are thus kept on the original trailers from loading point to final destination, so far as the warehousing operations are concerned; and handling is reduced to a minimum. The trailers are usually moved in trains of four or five loaded, or six to eight light; and one man with a tractor handles the convoy. There is a mighty contrast with the army of handlers that would be necessary to do the same amount of hauling with the old two-wheeled hand-trucks.

The trailers and tractors are of narrow gage. They track perfectly in the aisles and around the turns. For short trailer movements tractors are not employed, as one man readily handles on a four-wheeled truck twice or thrice the normal two-wheel average. The whole plant is laid out in definite one-way traffic lanes, carefully worked out to afford maximum access and minimum congestion. Bridges from building to building eliminate all necessity for the tractors with their trains to contend with yard conditions; for by means of a combined routing via elevators and bridges, a train can reach any point in the plant without crossing the open yards.

Speeding up and controlling the horizontal movement of the traffic is by no means the most serious problem confronting most plants and warehouses. As the number of levels or stories increases, the elevators become more and more the spout of the funnel and their efficiency limits more and more closely the rate of flow of goods. This consideration bulked large in the construction of the Brooklyn plant.

There are ninety freight elevators of 5-ton capacity, and six smaller ones for passenger service. In old-time buildings one finds elevators scattered about more or less at random, individually or at most in pairs. Modern skyscraper practice groups the shafts in order to facilitate jurisdiction and to secure a minimum interval between departing cars. The same reasoning applies in freight service; so the ninety cars in this plant are grouped in sections of from seven to ten cars each.

Elevators Run from a Central Switchboard

Even more radical is the departure made in the operation of these cars. They run without operators; they stop with the car floor accurately in register with the landing sill; the landing or hoistway doors open automatically when the elevator reaches and stops at the floor to which it has been dispatched; under no other circumstances will they open at all. Each group of elevators is operated by a single man, seated at a desk with a push-button switchboard before him. In each of the upright observation panels there is a white light for each floor, and a colored light at the top. In each of the horizontal control panels on the desk there is a button for each floor, bearing the number in plain numerals. It is almost superfluous to explain that for each car there is one of these observation panels, and one control panel.

In general service the operator gets calls for cars through his headgeared telephone, which maintains constant connection with a wall instrument in the middle of each elevator bank on each floor. A message comes asking for a car at floor seven to take flour for pier three. The dispatcher glances over his observation panel to see what car is idle and nearest the seventh floor. The white light in panel six and corresponding to the fifth floor is burning, telling him that this car is standing at the point indicated; the red light at the top of the pannel is burning, telling him that all shaft doors are closed. He touches button seven in panel six and the car leaves its station to proceed to the seventh floor. When it gets there it stops, and this fact is signalled by the appropriate light on the observation panel. With the stop, the shaft doors open automatically and the red light at the top of the panel goes out. This car is now out of the dispatcher's control; he cannot start it or otherwise influence it until some one on the seventh floor closes the door. This can be done either from the interior of the car or from a button adjacent to the wall telephone on the landing. The reappearance of the colored light is the signal to the operator to shoot the car to landing three; if he fails to observe this signal, it is only necessary to call him up and draw his attention to it.

This general service is the most difficult that the despatcher is called on to give. When certain elevators have been assigned to regular or fixed service for a time, such as handling a large volume of traffic from the second floor to the sixth, the lights alone tell the story; the appearance of both a colored and a white light in the same panel indicates that the car is loaded and awaiting action.

When the exigencies of operation demand that for a time a car be controlled directly by those at work on it, its panel can be disconnected from the operating board. This automatically throws the switch in the car into service, retaining the automatic opening and floor-leveling features. But until the panel is thus disconnected from the central board, the car switch remains inoperative.

Accurate Starts and Stops

This elevator equipment is really an epoch-making development. Though the push-button electric elevator was invented more than twenty years ago it has been used only for light passenger service in residences, apartment houses and hospitals. The reason for this is the inability of the machine to stop even on an approximate level with the landing floor. This is no peculiarity of the automatic elevator; every one who rides in passenger elevators has seen how the operator may run a couple of feet past the floor, and in the effort to return to the proper level run almost as far past in the other direction. Sometimes we are shuffled up and down past a landing three or four times before the level is struck with sufficient approach to accuracy to enable the door to be opened for our exit.

When the landing is not made with exactness, a person can still get off or on the car, stepping up or down as need may be. But with heavily loaded trucks this is not always possible. It may be very necessary that the truck wheels roll over the juncture betwen car and landing without shock or undue effort. As a sample of the consequences when this condition is not realized, we need only ask the printer what happens to a locked monotype form that is unduly jarred when the truck in which it is carried has to be jogged over a door-sill that is an inch or two out of level. And type is not the only delicate commodity that rides in the elevator.

The great difficulty in any attempt to devise a system that will stop the elevator accurately is the variable load. The man who runs an elevator from a control lever in the car will tell you that it makes a great deal of difference whether he has a car full of passengers, or whether he is running light. In the former case, for instance, he must begin to check a downward mov-

ing car at a considerably greater height above the landing than in the latter.

The installation by means of which this has been overcome calls, first, for a car and frame of very rigid construction, so that there is no appreciable deflection of the car floor in loading and unloading. Then in addition to the hoisting machine at the top of the hatchway, there is attached a small motor-driven worm-geared machine similar to the main one but of a much smaller size. The small machine is connected to the main machine through a revolving electric brake. The car runs from floor to floor under the control of the main machine; as the stop is about to be made the big machine is thrown out and the small one runs the car at a greatly reduced speed. The momentum tending to carry the car past the exact stopping point is thus greatly cut down, and the making of the accurate stop becomes a much more plausible matter. Also, with the slow speed, there is little wear and tear on mechanical or electric parts and the amount of power required for leveling is a minimum. The change from control of the big hoist to control of the little one is effected by cams which operate as the car comes within eight inches of the floor level; and when the control panel is thrown out to permit operation of the car from the control lever, the action is precisely the same.

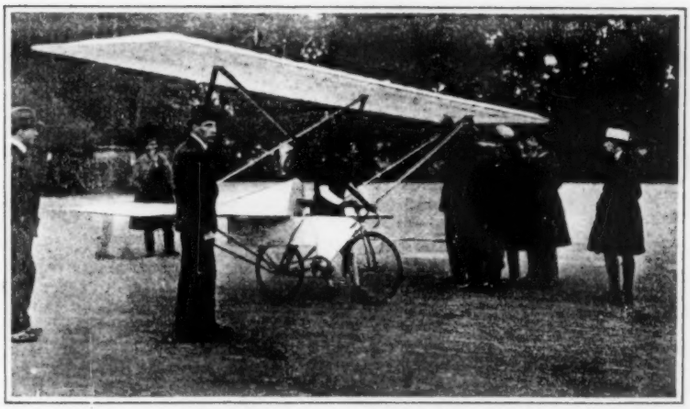
Automatic Door-Opening and Closing

The door-operating machine consists of a motor-and-sprocket-driven chain extending from top to bottom of the hatchway and return, which chain engages sprockets at each doorhead. Above each door is a small winding drum which serves to wind up cables that open the door. These drum shafts carry the hatchway sprockets, each of which runs loose on its shaft until a selective magnet-operated clutch, actuated through the floor control system, engages and turns the drum. As the doors are counterbalanced, similar but reverse action is required to close them, excepting that the closing operation can be initiated only by touching a closing button either on the car or alongside the door-opening on the floor.

This machine is actuated both through traveling contacts on its controller board and a contact on the main floor controller as well, so that it functions only at a predetermined floor. As it begins to function as soon as the reduced speed is entered, the stopping period also serves for getting the doors open, and more time is conserved.

The doors themselves represent a radical development. Consideration of the trailer-truck problem pointed the way to doors of maximum height and rising from fixed sills, rather than sliding horizontally. With the comparatively limited story heights involved, it was found necessary to project an opening door far enough into the hatchway for it to pass between the car top and the sill above. This has been accomplished by means of a most ingenious but comparatively simple arrangement of rocker arms, which, by the time the door has been lifted some 18 inches, shift it from the vertical plane of the sill to a plane entirely within the clear elevator shaft, where it is free to rise the full height of the opening. A cut-out is provided in the car for short circuiting the door contacts in fire or other emergency.

Ships are unloaded in part on both pier-shed levels and goods in transit between the warehouses and first transfer shed level reach or leave the latter on trailer trucks via the eighteen automatic elevators with which the sheds are equipped. As these elevators travel but one story only, the disadvantages of the single placements which conform somewhat to the locations of the ships' hatches are negligible, and the advantage obvious. These elevators are operated individually by means of buttons on each floor and in the car, but excepting for convenience no one travels with them and in all other features also they duplicate the warehouse elevators.



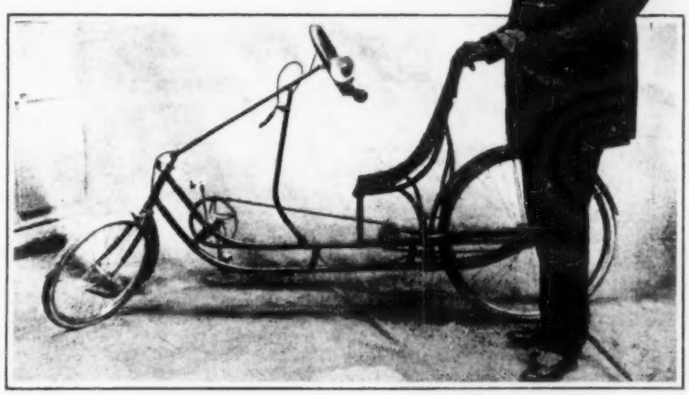
This winged bicycle is reported to have "hopped" 12 meters

Winged Bicycles Which are Said to Fly

WITH the return of sports in France there is a decided revival of interest in winged bicycles or motorless flying. In the days before the war there was no end to the numerous attempts at flying without power other than that generated by the would-be flyer himself. All sorts of queer contraptions with the conventional bicycle as the foundation, were entered in these contests, and months upon months of strenuous training preceded most attempts. Little came out of these contests, however, for the good reason that too little was known about aerodynamics to make flight possible with the small power available.

There now comes from Paris a report that winged bicycles are again appearing in large numbers, and there is much strenuous training taking place among contestants for the best flight, carried out with no other motive power than that furnished by the pilot. A message from Paris on August 11th announced that the well-known French cyclist, Poulain, had made a hop of 12 meters at a height of 1 meter, his speed being 9 kilometers an hour. The accompanying illustration shows Poulain and his successful winged bicycle, or "aviette," as the French call these little machines.

A story has been going round the press, accompanied by a photograph, stating that a motorless airplane has been raised by man-power at the Templehofer Field, Berlin, to "a height of 50 meters." The machine shown in the picture published in some daily papers is apparently the fuselage and undercarriage of the earliest type Fokker monoplane, fitted with gull-shaped wings of at least 25 feet span. The Germans claimed at one time to be super-men. One of them must certainly be a superman if this machine ever left the ground!



The easy-chair bicycle is obviously built for comfort and not for speed

The Easy-Chair Bicycle

IT has remained for a French mechanic to design a bicycle which is really comfortable. Indeed, while the conventional bicycle has been made in much the same manner for many years, motorcycle manufacturers did not take long to provide their cars with special backs for the seats, so as to reduce fatigue and increase comfort. Now there comes this bicycle which reminds one of an easy chair.

The easy-chair bicycle is provided with a steering wheel and horn, following French automobile practice. Judging from the reclining posture of the rider, this bicycle is designed for solid comfort rather than speed.

From Bigger and Bigger Airships to Smaller Airships

THE development of dirigibles for military and naval purposes has been largely in the direction of larger airships. Indeed, starting in 1912 with a length of 500 feet and a gas capacity of about 900,000 cubic feet, the Zeppelins grew to a length of 700 feet and a gas capacity of 2,200,000 cubic feet by the termination of hostilities. The British dirigibles too have grown in size until 800 feet and 1,000 feet of length are talked of as well within the realm of immediate realization. But while the dirigible for long-distance reconnaissance and bombing has grown in size, there has been a very distinct trend toward smaller dirigibles such as the coast patrol type familiarly known as the "Blimp."

With the advent of commercial aviation, it is interesting to note that the development for the time being seems to be in the direction of the medium-sized dirigible rather than the giant types. This, of course, is due to the fact that most projects, so far, have to do with short distances only, although the latest British dirigible R-80 has been mentioned in connection with an England to South American service. The R-80 is a rigid airship, with a gas capacity of 1,250,000 cubic feet. It is 535 feet in length and 70 feet in diameter. It is equipped with four 240-horse-power motors of the Maybach type. The gross lift is 36.5 tons, and the disposable lift is estimated at 15 tons. The full speed is 60 miles per hour and the cruising speed about 45. The crew consists of 20.

The R-80 is designed on up-to-date lines and may be expected to prove highly efficient within the limitations imposed by its dimensions. An advance upon other rigid airships is the shape of the hull, which has no parallel portion amidships, but is a symmetrical streamline form throughout its length. The construction and general arrangement of the hull, including the internal keel corridor, conforms generally with the recognized principles of rigid airship design, but incorporates several minor improvements in detail. The gas-bags are fifteen in number. Cruciform tail fins and balanced elevators and rudders are fitted. A point of recognition is the arrangement of the gondolas, of which there are three—one large gondola forward and a pair of "wing" power cars approximately amidships. The fore gondola is composed of two sections, flexibly connected, the leading section containing all the controls for the airship and the wireless cabin.

Very similar to the R-80 is the latest German rigid dirigible known as the

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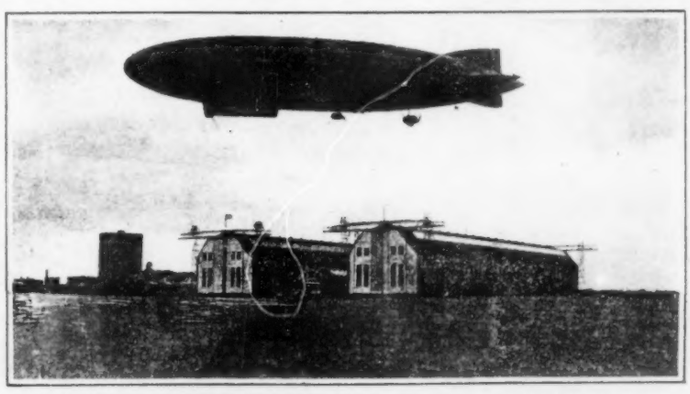
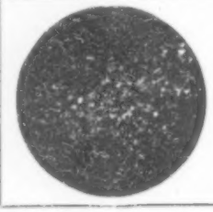


Latest German dirigible "Bodensee" which can carry 50 passengers at a time



The World of Neglected Dimensions

How Sub-Microscopic Colloids Are Assisting the World of Industry

By K. Knipe

LYING between the world of size and form, of solid matter and the hazy realm of invisible electrons, atoms and molecules, is the colloid, one of the tiniest and yet busiest of the world's workers.

The colloid's place in creation is best described by reference to the atomic theory of matter.

In the creation of all matter, things that may be seen and felt, the colloid forms the first visible link between the electron, atom and molecule and solid matter. Collections of invisible molecules form colloids that may be viewed by reflected light through the ultra-microscope. Collections of colloids, in turn, form solid matter, but it is while in colloidal form that they are of inestimable value.

Take, first of all, the human body. Water, coffee, tea, milk, many liquids are poured into this organism as a bowl or jar, and yet no leaks occur. The body is not rubber-lined and the colloid is responsible for its watertightness. In the process of digestion the natural chemical digestive juices divide food into exact colloidal particles. Were they divided any smaller the body would become a leaky vessel and the more finely divided particles of matter penetrate the tissues of the stomach.

Colloids found in Trinidad Lake asphalt, suspended in benzol, and viewed through the ultra-microscope, appear as innumerable pin points of light that dash back and forth across the field of the microscope in constant motion. They seem to be alive, so rapid and continual is their motion. This is known as the Brownian movement, named after the chemist who first discovered it. The generally accepted theory of this movement is that it is caused by the bombardment of colloids by the invisible molecules and atoms of the benzol in which the asphalt is dissolved.

Digging asphalt from the lake at Trinidad. Colloids hold our asphalt pavements on the street

In Trinidad asphalt pavements colloids prove their worth by increasing the surface area of the binder and thereby increasing the binding power. This is illustrated by taking a cube one-quarter (¼) inch square. It has six sides exposed. Divide it and it has twelve sides exposed. Reduce it to powder and then to colloidal size and the suface area of that cube has been increased about 100,000 times. The colloidal mineral matter in Trinidad Lake asphalt, placed there by nature, increases the surface area in this way and thereby holds the pavement more securely together, which accounts for its extreme durability.

In the dyeing industry colloids play a big part. The pigments of color used in dyeing are reduced to the size of colloids by chemical application. The cloth is treated with this solution and the colloidal pigments of color penetrate the very fiber of the cloth. Once firmly imbedded, another chemical is applied which coagulates or pulls together the colloids into larger particles, making it impossible for the color to escape from the fiber that it entered in its smaller form.

In manufacturing electric light filament it was found necessary to compound a colloidal alloy of metal so that it might be pulled out into fine wire and yet could withstand high temperatures without getting brittle.

In many industries colloids are vital. In photography it is the sub-microscopic colloid that holds the picture on the plate. In manufacturing ruby glass, colloidal particles of gold give the glass its reddish hue. In the manufacture of soap, mirrors, hydraulic cement, rubber, writing and printing inks, glue and many other commodities, colloids and colloid-chemistry are the foundation of the business.

In making mayonnaise salad dressing you are employing colloids. Cooking is a colloidal art, calling upon the colloid for aid in almost every step and in every operation.

The fermentation of milk is probably one of the most striking demonstrations of the presence of colloids in food. In its sweet state milk is a colloidal suspension. If allowed to stand in a warm place the acid resulting from fermentation coagulates or draws together the colloidal particles and they come to the top of the milk in clots known as whey, and the milk becomes sour.

The doctor is a staunch friend of the colloid. Iron tonics are really colloidal solutions of solid iron so divided that the system may assimilate the metal. Collodion gets its name from colloids and is used in healing cuts.

In washing, the application of water and soap forms a colloidal emulsion. Try to mix soap and alcohol or salt water and you will find that no soap suds will result and hence no colloids.

Chemists are busily engaged in studying colloids and harnessing these infinitesimal workers to bigger tasks. Dr. Wolfgang Ostwald, an authority on Colloid Chemistry says, "Only now has the true significance of this region of the colloid dimensions—The World of Neglected Dimensions—become manifest to us."

The new science, Colloid Chemistry, has immense and almost unfathomable possibilities.

British Conversion of "Useless" War Material

THE Munitions Inventions Department of the British Government, near Esher, England, is stated to be using the most expert inventive genius and up-to-date business methods with a view to finding commercial uses for the vast quantities of waste war material which the country has in stock. The *Times* of July 8 gives some interesting results of experiments which are being carried out by the department in sheds specially erected on the riverside estate of Imber Court. In conjunction with the Committee on the Utilization of Surplus War Material, the department is discovering many methods of working up odds and ends usually destroyed as being valueless.

In the construction of special crane piles of wood and wire (piles having the strength of steel with only one-third its weight) for airplanes and airships large quantities of wood sawdust accumulate. It has been found that this sawdust, on being mixed with glue and certain other substances and compressed, can be planed and worked in the same way as wood; by varying the pressure its solidity can be altered to suit the purposes for which it is required. Women's shoe heels, ear trumpets for airplane spotting machines, and many other articles can be fashioned from this sawdust material.

Shells of various caliber have been proved, by experimentation, to have considerable commercial possibilities. The steel of which they are made is in many cases capable of being rendered glass hard, and milling cutters have been produced which are reported to have stood the most exacting tests. After a little manipulation in the lathe, an 18-pounder shell, minus nose and copper band, makes an excellent shafting coupling, the copper bands selling at a good price for electrical and other purposes. A 6-inch shell in the same way becomes a fine flexible coupling, and so on. Shells being already hollowed out, there is a great saving in labor and material by using them instead of solid steel for couplings and other articles, when the dimensions are suitable. A special lathe extension constructed from spare parts enables waste 18-pounder cartridge cases to be cut into strip brass; and containers from shrapnel shells can be used, with a slight alteration, as lamps.

The most interesting and important experiments from a commercial point of view are said to be those in connection with the utilization of airplane engines for ordinary commercial purposes. By making an alteration in the carburetor it is possible to run the engines on coal gas, and with couplings made from shells they have been connected to dynamos with very good results. While second-hand airplane engines have a limited market, it is believed that as stationary power units they will prove a useful innovation. The experiments made with them at Imber Court are said to have proved them to be most reliable and economical as motor-boat engines, driving pumping apparatus, and for numerous other purposes. On one such machine an air bomb has been fitted as an expansion chamber and silencer; on another, a similar article is in use as a compressed-air chamber; a tank, with the unnecessary part cut away, and a bogey fitted at each end, has been made into a valuable workshop locomotive.

Artificial limbs and other devices also come within the scope of the Munitions Invention Department. A portable bridge is one of the latest developments. A 50-foot length of this bridging can be carried easily on a light motor van, and, during test, such a length was unloaded, got into position, and crossed by twenty men within the space of six and one-half minutes.

The examples quoted above are only a few of the interesting ways in which the British Ministry of Munitions is said to be endeavoring to obtain for the nation the highest possible cash return for war material, and generally to avoid waste.

Dyeing has much to do with colloids; in fact, it is the colloids that keep the dye in our clothes

Christmas Made in America

How the Tree Ornaments for Which We Have Always Depended on Germany Are Now Produced Here

BEFORE the war practically all the beautifully glistening balls and other ornaments for the Christmas trees of American kiddies were made in Germany. Now with the war at an end the German toy makers when they begin to seek export trade will find the market for their goods in America at an end; just as good balls and Christmas tree decorations are now made in the United States as Germany ever produced and at hardly greater cost. This Christmas every tree in America will be adorned with such ornaments—real American products, made by skilled American toy makers and glass blowers. Even the dyes with which these decorations are charmingly colored are American made.

The first Christmas succeeding the outbreak of the great world's war German-made Christmas tree ornaments were still fairly plentiful in this country and good old Santa Claus had no trouble in finding all he wanted to deck the trees of American kiddies. By the next season however, the Allies having meanwhile put an embargo on German toys, foreign-made Christmas tree ornaments were very scarce and high in price. Still they were to be had by those willing to pay what was asked for them. But when Christmas, 1916, arrived, the foreign stock in this country left over from previous years, had been entirely exhausted and many promised trees had to be abandoned that holiday season because of an utter lack of good decorations.

So last Christmas, in an endeavor to meet the insistent demand for tree ornaments, American-made tree decorations first appeared in the toy stores. But war or no war, few kiddies can get along very contentedly without their tree.

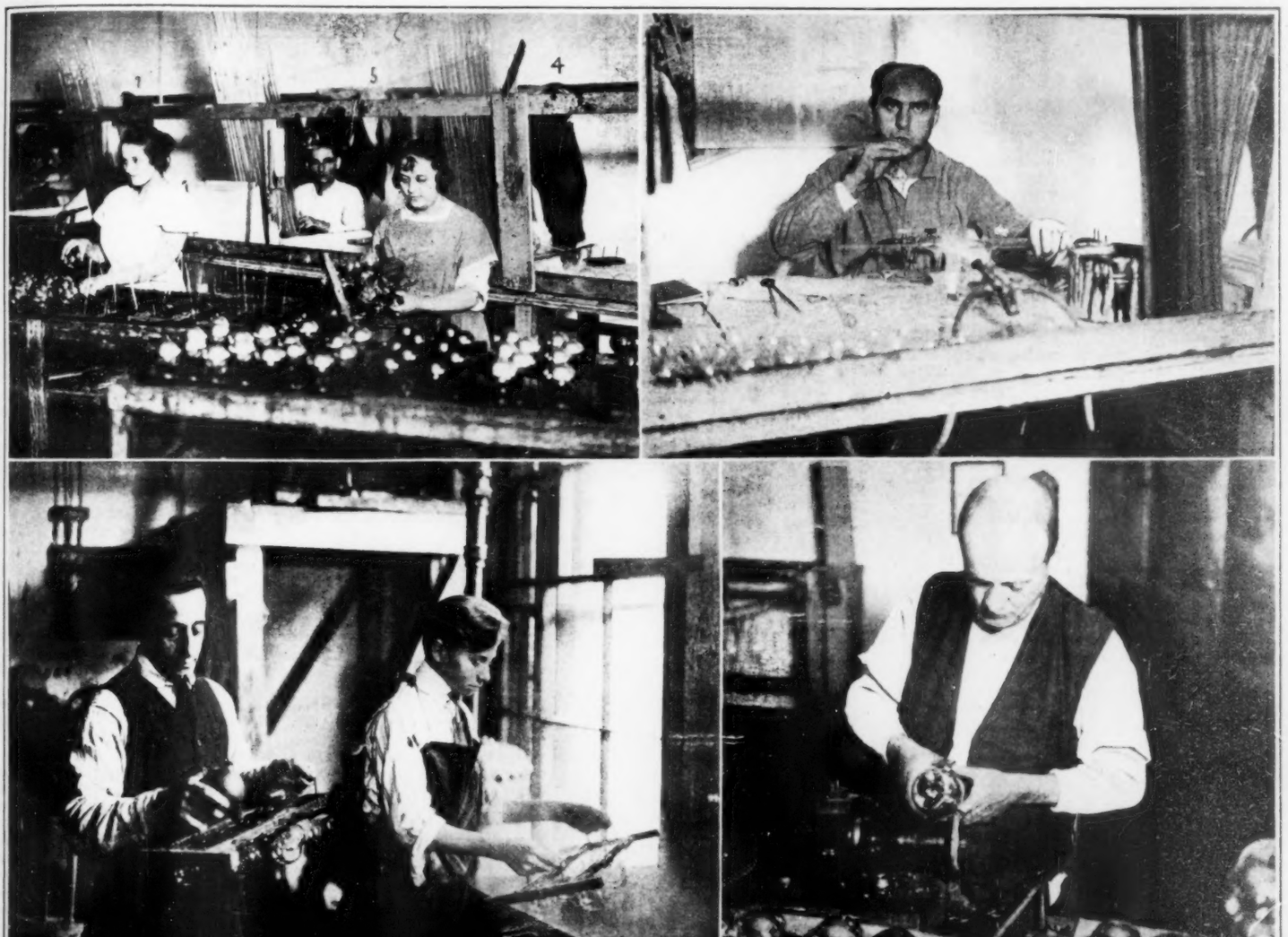
If the unvarnished truth be told they were poor and rather crude imitations of the German articles—so defective in fact that when they were hung on the trees, even the children noticed the difference and wanted to know what was the matter with Santa Claus. There were very good reasons for this. Fast American-made dyes were hard to obtain and we moreover lacked the experience in making the balls and other ornaments which the Germans had only attained after many years of constant practice.

But it is not the American spirit to give up a difficult job, least of all to the enemy, and wonderful progress has been made in the past twelve months in the manufacture of blown-glass Christmas-tree decorations in this country. This year Old Santa will find in the United States as full a stock if not as great a variety to select from as he ever had. Moreover practically all the early crudeness has been polished off these ornaments and they are now quite as beautiful as any Germany ever offered us. In fact, we are now quite independent of the "made-in-Germany" toys of this nature and our manufacturers have every intention of seeing that we remain so.

This year they will furnish Santa with practically all of the goods of this sort ordinarily needed by him to delight American children at Christmas time, and it is not expected that anything like the general and acute shortage of ornaments which developed two years ago will be duplicated this Yuletide or any to come for that matter.

The fact that this step forward in a new American industry has been made while we were in the midst of a great war makes it all the more noteworthy, because of the many, and in some cases quite serious, handicaps under which our manufacturers have had to work in that period. The shortage of labor and fuel and the problem of transporting raw materials as well as finished products were serious matters in all industries, but in one which cannot really be termed essential, except to the holiday happiness of many American tiny tots, these questions assumed menacing pro-

(Continued on page 398)



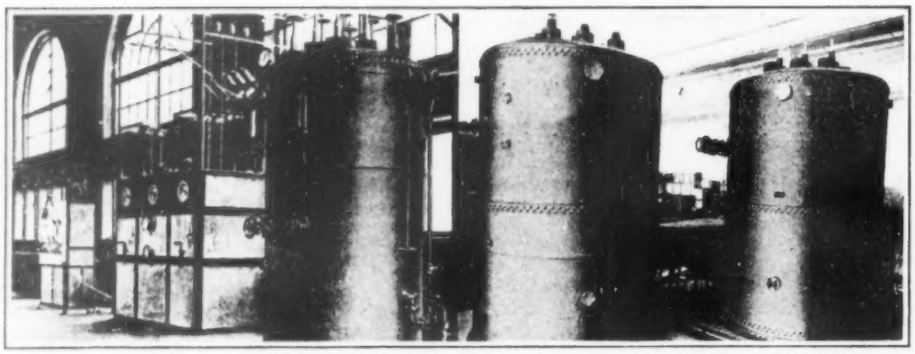
Several stages in the manufacture of Christmas tree ornaments, now being carried out in this country

Above, left: Preparing the blown balls for the silver nitrate treatment. *Right:* Glass blower taking the first step in the manufacture of one of the ornaments. *Below, left:* Dropping silver nitrate in the balls to make them glisten, and dipping the nitrated balls in a steam bath to spread the nitrate evenly over their surfaces. *Right:* Clipping the long stems from the blown balls and putting in the rings by which they are hung to the trees.

Electrically-Heated Steam-Boilers

AT first sight it seems a rather round-about procedure to heat steam-boilers by electricity. The use of radiators involves losses, while their wear and tear results in unpleasant disturbances that cannot readily be checked; in fact, the chances of an experiment in this direction are as bad as possible.

Still, there have lately been some such plants either building or in operation. Local conditions in these cases were, truth to say, rather unusual. Cellulose and paper mills in the north of Scandinavia, the machines of which were operated by water power, required for their manufacturing processes large amounts of steam which could not possibly be generated by means of coal, especially in view of the present coal crisis in countries that have no coal of their own.



Two views of a set of 1500-kilowatt boilers, constructed for a Swedish plant, in which the water is heated directly by electricity through its own action as a resistance member. The boiler efficiency is 95 per cent. and upwards

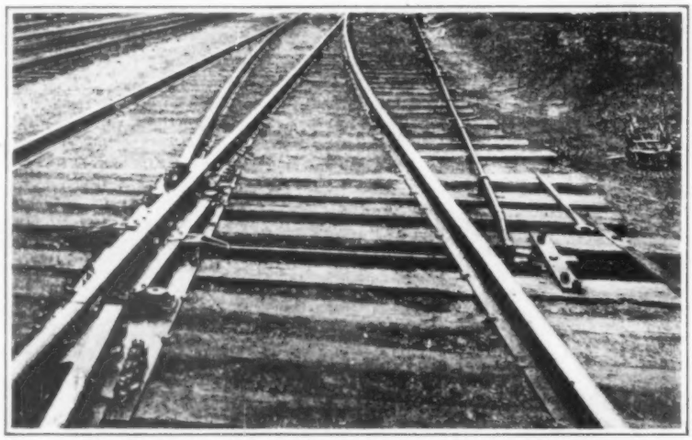
However, the engineers who took hold of the matter, were in a position to use quite a novel process for firing with "white coal," without any radiators, the electric current itself heating the water.

In the interior of a vertical boiler there are installed a number of narrow vertical tubes of insulating material, which are open at both ends, thus forming from the boiler water a series of liquid columns that communicate at the top and underneath with the rest of the boiler water. The water in these narrow tubes itself serves as resistance to the electric current, which is supplied by means of electrodes and which, on account of the very high resistance offered by the long and narrow water column, should possess a very considerable voltage. On the current's passing through the water, the latter is immediately heated and vaporized, a process obviously showing the advantage of absolute reliability.

The current used in this connection should be alternating or three-phase. In the case of three-phase current, each set of three tubes constitutes a system connected to the three phases, the number of systems being dependent on the boiler output required. Each set can be thrown in and out separately from the switchboard. Moreover, by altering the mutual distances of the electrodes (by means of hand-wheels from the boiler itself) there can be effected a fine regulation of each set, designed for high-voltage current and at the same time for high-tension steam. The boiler comprises all regulation fittings for water and steam.

Inasmuch as the electric current is integrally converted into heat, there cannot be any losses save by the outward heat radiation from the boiler walls. However, these losses can be reduced to a minimum by a satisfactory insulation of the boiler. The efficiency of the latter, therefore, is very high, being 95 per cent and more, in accordance with the size of the plant.

The output of such an electric boiler can be determined from the fact that a kilowatt-hour will generate about 1.15 kilograms of steam at a pressure of 6 to 8 atmospheres above the surrounding pressure. A thousand kilowatts thus allow about 30,000 kilograms of steam to be produced in about 24 hours of uninterrupted operation. It is advisable to subdivide the output required into several units, thus avoiding any interruption of the whole output. Electrically-heated steam boilers have so far been designed in units of up to fifteen hundred kilowatts, the voltage applied to the boiler being up to ten thousand volts.



The frogless switch that eliminates the bump at rail crossings

A Continuous Rail at Cross-Overs

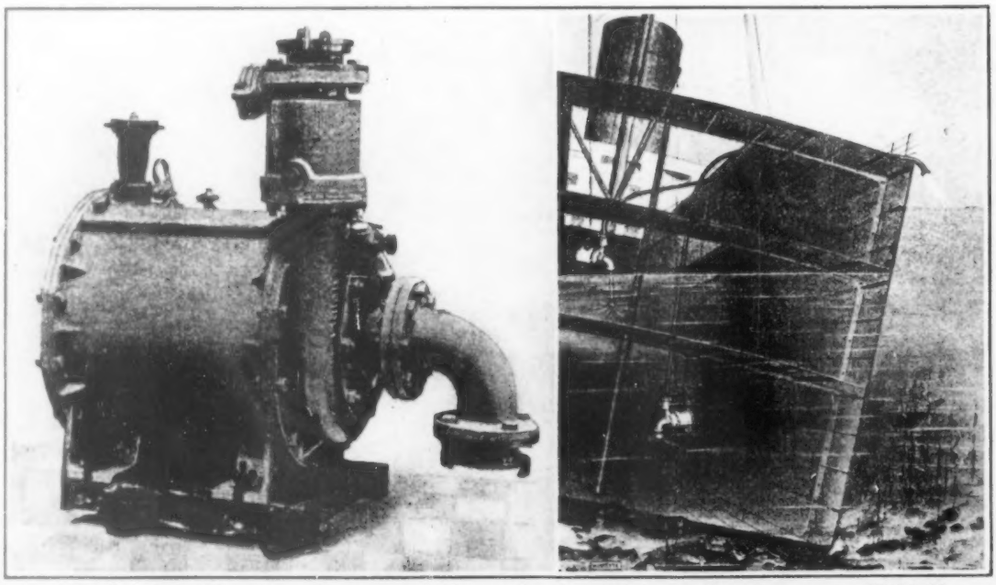
RAILROAD men will concede unanimously that the good old-fashioned frog at the crossing of flangeways in front of a switch leaves a lot to be desired. Various and sundry schemes have been advanced as a substitute for the frog in the effort thus to eliminate the jump of the wheels. One plan of course is the spring-rail frog, while another is the placing of an ordinary piece of rail in such a manner that it can swing into line with either of the crossing rails according to the position of the switch. Such a rail section of course must be interlocked with the switch.

A Kansas City concern has developed an installation of this type which we illustrate and which is giving good satisfaction in a number of places where it has been tried. Thus, there is a 75-pound rail-frog and stub switch on an electric interurban road near Kansas City, installed on a 30-degree curve and operated from a switch stand. There is a 90-pound rail-frog at Casa, Col., at the end of the Santa Fe's double track operated by a special mechanical interlocking plant, with two switches and one frog on the same lever. An exceptionally severe experience here has demonstrated that expansion and contraction of the track does not interfere with the interlocking or other operation of the rail-frog.

Again at a very sharp curve in Pueblo, on track used by the Santa Fe, the Rio Grande and the Colorado and Southern, and accordingly subject to very heavy mountain traffic, the ordinary frog had to be renewed every three months, while the rail-frog has been in continuous use since May, 1918, without a renewal. In points at the St. Louis and Denver Terminals, subject to the most severe traffic, a showing of the same sort has been recorded.

On the R. F. & P. at Richmond, Va., a 100-pound rail-frog is operated by a switch stand on one of the busiest lines in the country. Here, in addition to plunger locks at both ends of the frogs, which lock after the rail is swung into alinement, all under one movement, there is a six-inch plunger-lock so connected that the frog must be properly lined and locked or the clear signal cannot be given. In power plants with electric signals, the same end is secured by a switch box connected with the frog, so that the signal contacts can be made only when the frog is in the proper locked position.

Among the subsidiary advantages of this rail-frog is the economy involved in the absence of guard rails at cross-overs; and the additional safety element attained through the impossibility of trainmen and others getting their feet caught in these. It is also pointed out that they can be installed with the greatest ease by any construction gang, all that is necessary being the cutting of a rail section of proper length out of the rail that is being laid. In this way, too, the rail-frog will always match the main rail in size and weight, and hence will wear out no more rapidly than the regular track does.—*F. C. Perkins.*



A detailed view of the submersible pump and the procedure by which it goes down into a water-filled hold to pump it out, the first step in the salvaging operation

Submersible Pumps

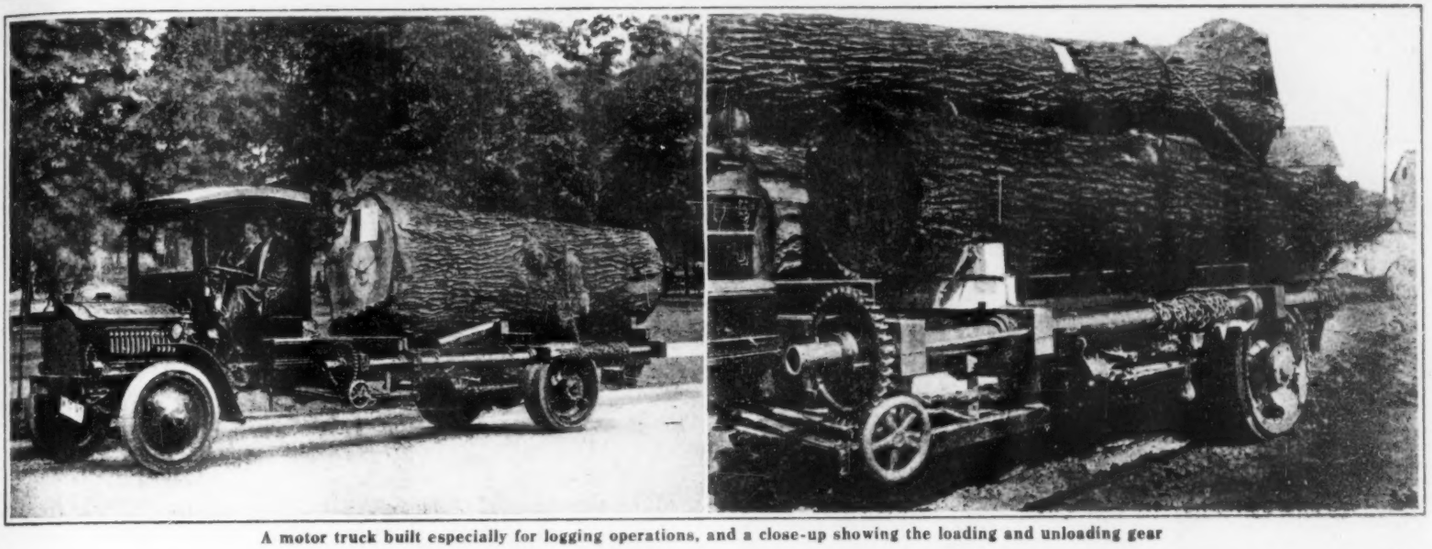
THE accompanying illustrations show an English submersible motor and ship saver, as developed at Southall, Middlesex, England. It is pointed out that the compact build of

(*Continued on page 402*)

The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGÉ, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features operation and management of commercial motor vehicles

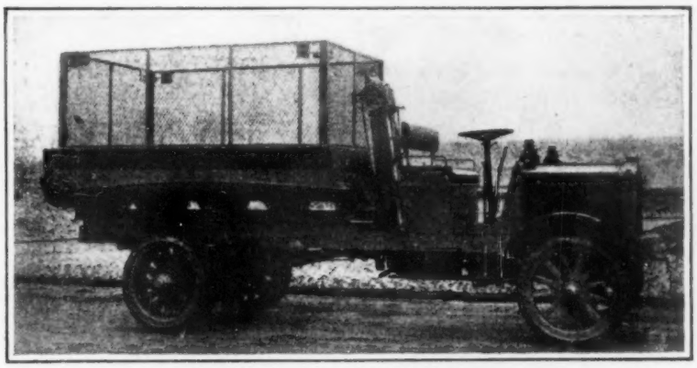


A motor truck built especially for logging operations, and a close-up showing the loading and unloading gear

The Logging Truck

AMONG the special services for which the motor truck is well adapted is that of hauling logs from the woods to the railroad or the mill. One reason why the truck is apt to give better satisfaction in this game than the more familiar process of logging with horses is that of the power and capacity of the truck: another, and quite as vital, is the possibility of employing the truck engine for the operation of loading and unloading devices. The view above showing the single large log on a truck is mute but eloquent evidence that the problems of getting a log on and off the truck may often be the limiting factors in motorized logging, rather than any question of the truck's capacity.

The special logging truck which we illustrate, it will be seen, is provided with a special gear which not only loads and unloads the logs with a great deal of ease, but which is so assembled as to be an integral part of the arrangements for chaining the logs into position on the truck. The truck illustrated is of 3½-tons capacity, and is in constant use by an Indiana lumber concern in hauling to and from the forest and the mill. The big oak log in the left hand view, which is honored to the extent of being a solitary passenger, is close to six feet in diameter at the base and some 15 feet or more long.



Combination truck-body for farm use

New Garden Tractor

AN engine manufacturing company of Lansing, Michigan, has recently perfected a garden tractor which has also proven to be very useful for taking the place of a horse on the golf course for drawing a triplex lawn mower. The illustration clearly shows the simple method of attaching the little tractor to the mower. The engine is the air-cooled slow speed hit-and-miss governor type, and the machine is controlled by a single lever and steered by means of handles. Special tractor wheels are provided which have lugs that are extra long and extra wide; they are designed in such a manner that they bear upon the lawn without injuring or marring the sod. The speed of the tractor is two and one-half miles per hour, the same as that of a horse, and the machine consumes about four gallons of gasoline per ten hours. The control handles are extensible, so if placed in the low position the tractor may be guided by a man walking behind it as is necessary when it is used in garden cultivation. When the handles are extended, as in the illustration, the operator can ride on the appliance being towed.

Farmer's Truck With Combination Body

THE farmer who uses a motor truck usually wants it, not for one particular kind of work, but for all kinds of service—anything that needs to be done on the farm. So far as the chassis is concerned this does not make much difference, but the body is what counts.

A Pennsylvania farmer who uses a 3½-ton truck built by a prominent western firm has equipped his machine with an ingenious combination body that can be used for a great many different purposes. The body proper is of steel, and at the forward end a hydraulic dumping mechanism is fitted so that loads can be quickly dropped without resorting to manual labor for the purpose. Of course this body can be used equally well for stuff that must be loaded and unloaded by hand. When live stock is to be carried a steel wire cage is fitted, the sides and ends being of sufficient height to make the carrying of animals quite safe. The cage is carefully fitted so that its attachment and removal are effected with little trouble. The cage is also useful for carrying loads that are bulky in proportion to weight, preventing the spilling of material when under way. The combination is said to have been in service for a considerable length of time and to have given most satisfactory results.

A garden tractor for drawing grass cutters and similar machines

Motor Trucks Increasing in Number—100 Times in 10 Years

TEN years ago the number of motor trucks in use was but 4,000. Today there are between 400,000 and 500,000, according to James P. Nash, Engineer, State Highway, Department of Texas. There is no reason why the number of trucks should not increase next year in the same ratio as in the past. If the number of motor trucks augments in the next ten years in the same ratio as in the past ten years, there would be over 22,000,000 motor trucks in use in the United States by 1929.

The highways of the country are inadequate for present needs. Their capacity must be doubled to meet the augmenting requirements of the next year or two. Engineers are wondering along what line this increase shall be provided. One suggestion is to double the width of the roads and increase first cost and maintenance 100 per cent. The most reasonable one is to provide a road of sufficient strength to carry vehicles of 100 per cent greater capacity for a given width of road as the first cost of these strengthened roads would be only 10 to 20 per cent greater per mile than that of present inadequate highways. In view of the fact that 50 per cent increase in hauling capacity gives a reduction of 15 per cent in transportation costs, the latter seems the wisest thing to do.

Some Industrial Uses of the Potato

(Continued from page 388)

Alcohol From Potatoes

Potatoes as a source of industrial alcohol are of great importance in Europe, but negligible in this country. Here again the Germans have the lead, partly no doubt because of the abundance of their potatoes as well as the scarcity of their petroleum. It is thought that prior to the capture of Rumania where much petroleum was found these peoples used considerable potato alcohol for the army trucks and automobiles. It is also used for light and heat, thus as someone has said, "one potato is used to cook another." Other uses are in the arts for the manufacture of varnishes, explosives and other chemicals.

In the manufacture of alcohol from potatoes the idea is to break down starch (by the action of malt) into sugar. Then the ferment caused by the addition of yeast causes the formation of alcohol which is separated by distillation. Cleanliness is very important in the operation as the ferment nourishes other organisms.

Germany has 5,000 farm stills using potatoes for alcohol and more using grain. The season is longer than for the starch factory but it is not advisable, say some, to operate in summer on account of the necessity of cooling the water, which would be expensive. A drawback in this country would be too few potatoes in some years.

A still of 1,000 gallons mash capacity in ten hours cost, in ordinary times, $12,000. The cost of this might be less of a drawback than the difficulty of enforcing prohibition with "a still on every farm." Little but talk has resulted from our efforts to get industrial alcohol. However, with the passing of petroleum, alcohol looks now to be the leading substitute and the use of potatoes as a source has much to commend it.

The great bugbear of the farmer, which has caused him more insomnia than a protracted drought or a long wet spell, is a glut. Overproduction we would term it in industry, but the farmer's products can't be kept well. This knocks his prices down to the ground and under. This year beans may be a dollar a bushel; next year they will not pay for the picking. Potatoes suffer from a glut about as severely as any other product; but in Germany where there are alternative uses for the tubers the fluctuation is almost negligible. If they are not wanted for starch or alcohol or flour, dry them.

That our Uncle Sam has not cultivated his potatoes assiduously is apparent from this consideration of their uses—most of them foreign to the United States. That we could raise ten times as many as are now raised is not exaggeration. Our soil is as good or better than that of Germany and we have somewhat the better of the rainfall. As for brains, we have finally convinced the German that we are just about his equal. When it comes time we can turn our attention and our energies from making the first submarine and airship and torpedo, and the best tools and locomotive, and raising the most corn—to looking after our potatoes. Then we will increase our starch content as they have and pick out suitable varieties and put them to industrial uses as our needs require. That such time is near at hand seems apparent.

From Bigger and Bigger Airships to Smaller Airships

(Continued from page 391)

"Bodensee," which, we are informed, is one of the several airships that are to be built and operated by the Hamburg-American Steamship line. The "Bodensee," which is shown in the accompanying illustration, recently made her maiden trip from Friedrichshafen to Berlin, a distance of about 450 miles, in approximately six hours. This airship is in the neighborhood of 400 feet in length. On the maiden trip the airship carried ten press representatives and three women and nine men passengers, besides the crew. However, it is reported that the accommodations available are for fifty passengers, which number, probably, is meant for cruises of 500 miles or less.

While the medium-sized dirigible is being developed in Great Britain and Germany, and to some extent in France and Italy and the United States, the super-dirigibles are by no means being overlooked. When there is a real demand for trans-Atlantic dirigibles service there can be no doubt that dirigibles of 800 to 1,000 feet in length will have to be employed in order to carry a sufficient number of passengers to make the service profitable. For the time being, however, it is the medium-sized dirigible which is being developed for short-distance service.

Christmas Made in America

(Continued from page 393)

portions. There is a good assortment of so-called irregular shapes and twisted balls now being made here which equal, if they do not surpass anything of the kind which was ever imported from the other side. Perhaps there is not yet the great variety of these fantastic models produced here, when compared with those formerly imported, but a big step has been taken in the right direction, and it augurs well for future progress along these lines.

There is, however, still to an extent a dearth of certain fancy tree novelties such as formerly came from Germany, which as yet domestic manufacturers have not been able for various reasons to duplicate in substantial quantities. Among these are fancy glass balls blown into the various fruit shapes, dolls, Santa Clauses and other odd and difficult modelings. Our lack, as yet of a more general success in this direction is to be found principally in the quality of most of the glass obtainable in this country during the war. Very little of it was sufficiently elastic to be blown into these odd shapes containing rather severe angles. Most of our glass at present in the market is somewhat brittle, even the best of it, and there is an unprofitably high percentage of breakage when the more extreme fancy shapes are attempted. There is, however, a little glass made in America of nearly the proper quality and there are a few among our manufacturers of tree ornaments who are fortunate enough to have help sufficiently skilled to work this glass up properly.

By another Christmas, with the glass being made and the work being done under peace instead of war conditions, it is confidently predicted that there will be a full and plentiful supply of all these fancy glass novelties American made.

On the other hand, quite a few American manufacturers have, as their products show, already met with considerable success in the production of blown-glass ornaments with what is known as the sanded-glass finish. It is obtained by first coloring the article to be thus treated in the desired shades, then lacquering them. While the lacquer is still wet, powdered or very fine ground glass is sprinkld lightly over them. This, when properly done, produces the rich, soft luster of velvet which glistens when the light strikes it, through what seems to be an outer dullness.

The great difficulties which manufacturers of tree ornaments had last year in the matter of dyestuffs seem now to have been almost entirely overcome, with the possible exception of fire red. It still appears to be difficult for us to turn out a fire-red ball which is entirely satisfying, although last year's abortive reds have been very greatly improved on.

There remains, however, a slightly perceptible brownish tint in the average run

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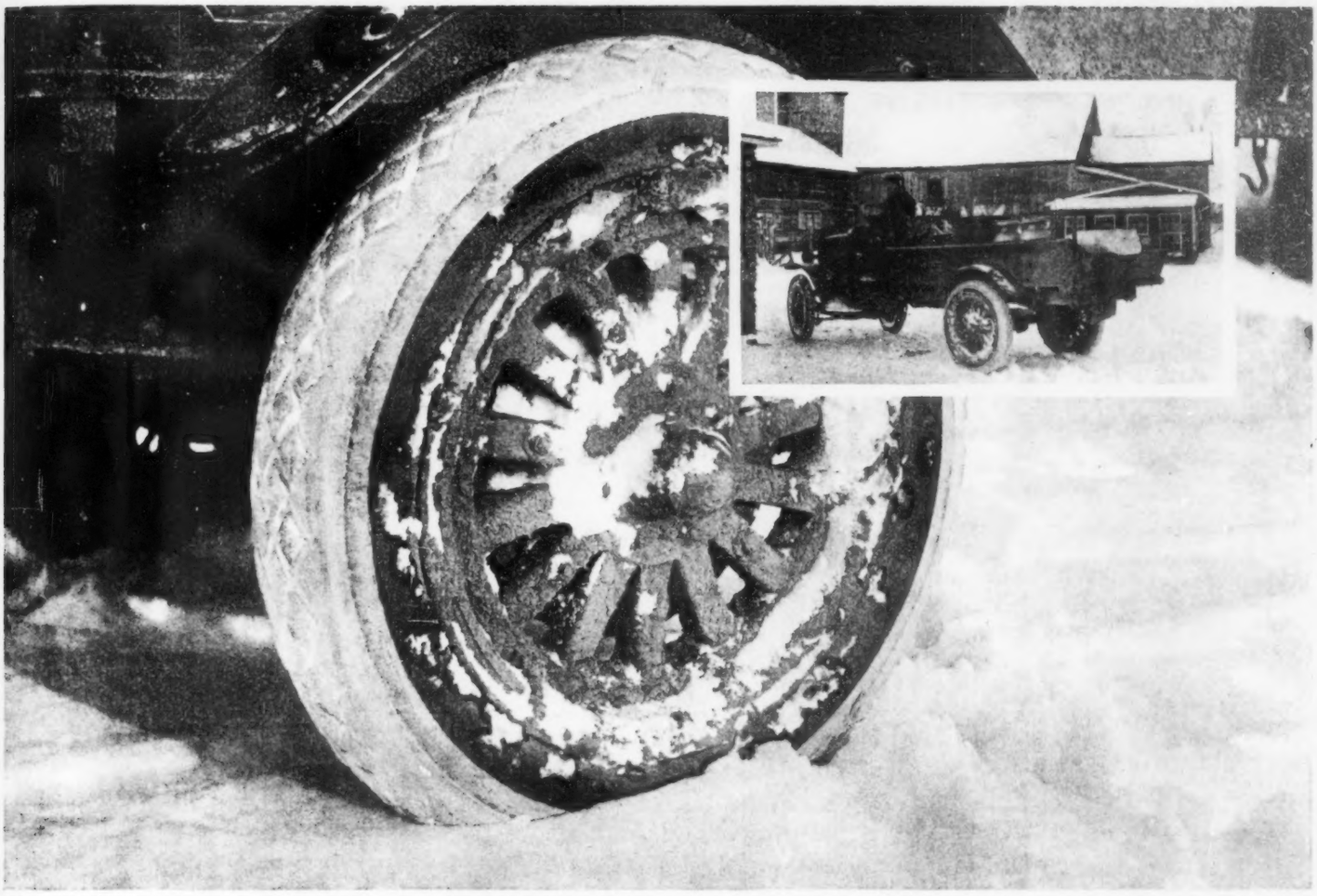


"THE motor truck dealer was right when he advised me to use pneumatics on my dairy farm truck. The Goodyear Cord Pneumatics are good snowshoes for the truck. They plow right through snow and mud. I am never delayed on account of slippery going. The Goodyear Pneumatics are right in every respect for my dairy farm work, winter and summer, and that means they are tough."—Mr. Paul J. Grube, Mountain View Dairy Farm, Plattsburg, New York

ONCOMING winter, with its snow and ice, will bring no thought of frequently delayed milk deliveries to the owner of Mountain View Dairy Farm, near Plattsburg, New York.

When the photograph above was taken last January, Mr. Grube's motor truck on Goodyear Cord Pneumatic Truck Tires was covering its 25-mile route daily just as it had done during the preceding summer.

Under similar conditions, Mr. Grube had known solid tires to spin and get stuck, and on one occasion he had used his Goodyear-Cord-equipped truck to pull a solid-tired truck out of a miry place.

Further, the big Goodyear Cords were saving two hours in the morning, formerly spent in getting the horses ready; they were saving much time in collecting milk from neighboring dairymen and, then, in delivering it; and they were saving considerable money under the cost of keeping horses.

Now more evidence of the economy of the Goodyear Cords is afforded in their record of 22,000 miles to date, with all four tires still on original air and still rugged looking.

This latter fact supplies a very important reason why the general city and rural adoption of Goodyear Cord Pneumatic Truck Tires has proved so uniformly successful.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

GOODYEAR

AKRON

World Markets for American Manufactures

Edited by LYNN W. MEEKINS

A department devoted to the extension of American trade in foreign lands

Prosperous Scandinavians

FROM Copenhagen, which he describes as the best-fed city in Europe at present, an American business man writes: "We are having five meals a day. There is a shortage of wheat flour, but other foodstuffs are plentiful. A friend of mine has just come down from Stockholm to 'acquire a hump,' as we call it here. Denmark's new prosperity is reflected in the repurchase during the war of almost all its foreign loans. Only a lack of raw materials prevents Danish industry from assuming its pre-war proportions.

"Copenhagen has replaced Hamburg as a trade center for Northern Europe. It has had a free port for 25 years and is now about to spend more than $3,000,000 in harbor improvements in order to accommodate a large number of vessels and to handle all kinds of cargo. Copenhagen is the Paris of the North. Its people are almost as punctilious in dress as the English and pay as much attention to polite customs as is found in Latin countries, men tipping their hats and bowing as they meet. It usually surprises the stranger to see the women smoking strong, black cigars in the restaurants. Cigarettes made in Denmark generally contain about everything except tobacco.

"Business hours in Copenhagen are in most cases from 10 to 4, with an hour or two for lunch. Nobody is rushed and there is plenty of time for everything. This might be expected in a tropical country, but in a northern clime it seems extraordinary." When this letter was written American goods were coming into Denmark in considerable quantities. Twenty salesmen carrying various lines arrived from the United States on one vessel.

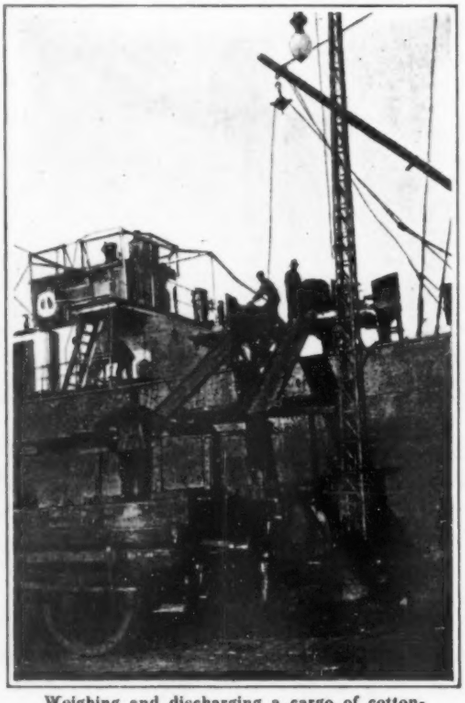
Owing to the utter lack of mineral resources, Denmark's industris are solely dependent upon imports of iron, steel, other metals and fuel. The margarine factories use cottonseed oil brought from the United States. Danish railways are in great need of additional rolling stock. The shipyards require steel and other necessary materials. As to general merchandise, many orders were placed in the United States and elsewhere during the blockade, resulting in the temporary overselling of not only Danish but also Norwegian and Swedish markets. Now that the terms of peace have been settled, much of this stock will be re-exported to other parts of Europe.

American Cash Registers for Norway

Although Norway is the most thinly populated country in Europe, its 2,500,000 people want many American goods, both for consumption and for use in manufactures. Before the war seven-tenths of Norway's foreign trade was with countries bordering upon the North Sea, but if the United States makes efforts to continue the direct connections established during the past few years there is a fine opportunity for the sale of a long list of American manufactures in that country. An American salesman visiting Christiania saw a shipment of American cash registers arrive, together with automobiles, leather and food products. "Such articles as soap, men's clothing and books are being received from England," he said, "but these are as handfuls to carloads compared with American imports."

Norway depends for its existence upon three F's—forests, fisheries and falls. In available waterpower it is perhaps the best-endowed country in the world. Fish and fish products comprise one-half of its exports and forest industries one-third—five-sixths altogether. So far most of Norway's "white coal" has been used in the manufacture of electrochemical products such as nitrates, calcium carbide and ferrosilicon. The constantly adverse foreign trade balance has been offset by the income from shipping. Norwegian vessels carrying the products of many nations.

During the period from 1913 to 1918 bank deposits in Norway increased more than threefold, and the huge growth in financial wealth has brought about largely augmented investments of capital in banking, shipping and industrial enterprises. This money must be spent, however, in purchasing all sorts of foreign goods to supply the many economic wants of the kingdom. American manufacturers with representatives in Christiania or Bergen, the principal trade centers, can cope with the keen competition to be expected from Great Britain and other countries nearer to Scandinavia. A factor in prices is the comparatively low Norwegian customs tariff. Except for a very few articles, duties are levied upon quantity and not ad valorem.



Weighing and discharging a cargo of cottonseed cake on arrival from America in a Scandinavian port

Motorcycles Used by Swedish Mail Carriers

The postoffice department of Sweden recently placed an order in the United States for 25 motorcycles to be employed in making rural deliveries. American motor trucks are also being purchased by Swedish firms, and it is reported that a demand exists for passenger cars of strong construction that can be sold at about $1,000. American typewriters and office equipment are popular in Sweden. Inquiries are coming into the United States from firms in Stockholm, Goteborg and other cities for high-grade ready-made clothing and shoes.

An indication of the prosperity in Sweden is the wonderful growth of postal savings, which increased by nearly $3,000,000 last year. The high cost of production has caused Swedish manufacturers to make every effort to extend their export trade, so that goods may be turned out in larger quantities and economies effected. Precision tools are a line in which Sweden specializes, and the quality of its safety matches was emphasized when the supply was cut off during the war and very inferior substitutes came into the United States from other parts of the world.

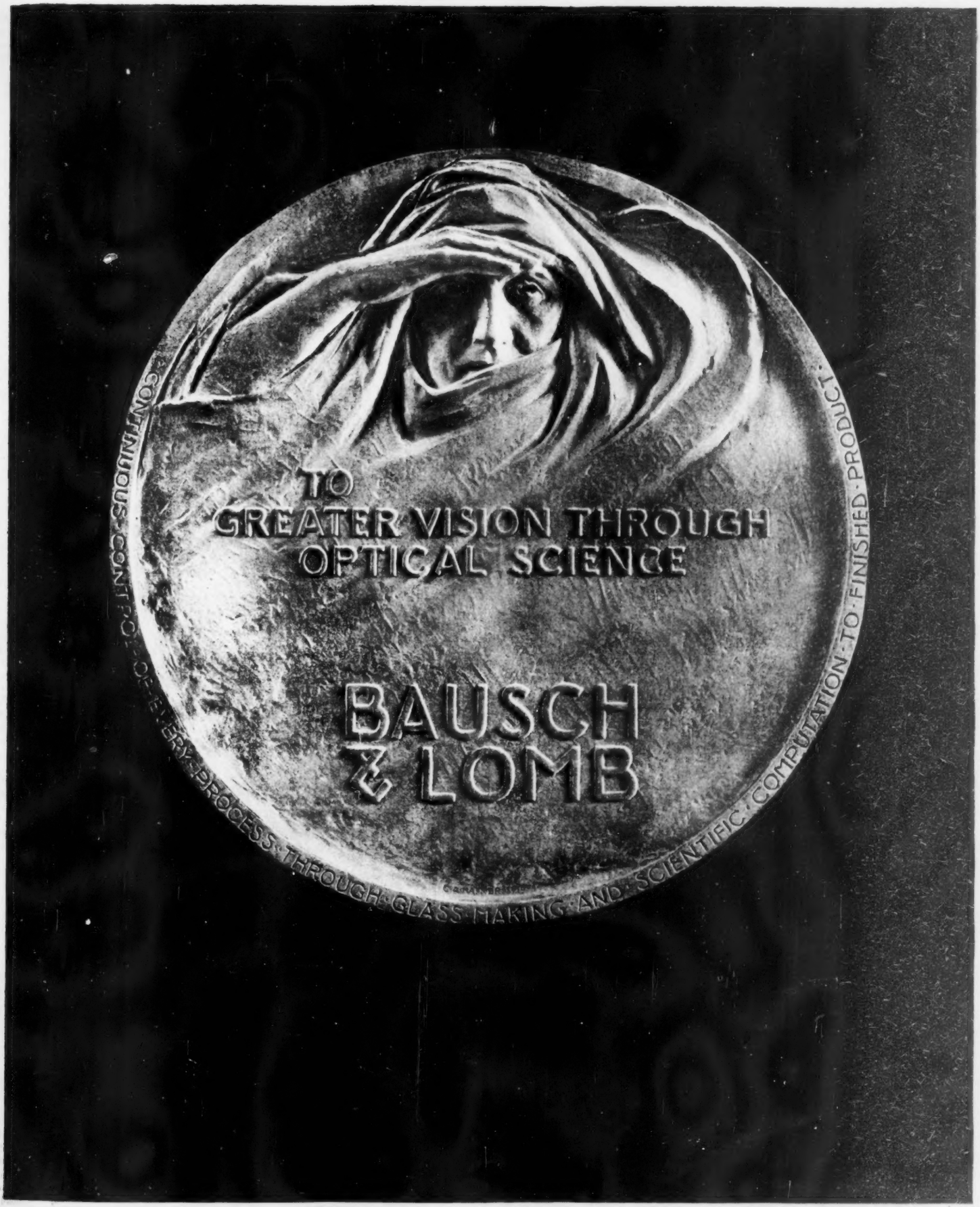
Like the other Scandinavian countries, Sweden must have many kinds of raw materials for its industries—for instance, glass factories are dependent upon the importation of potash and paper mills need sodium sulphate and chloride of lime. During the embargo a number of new industries were started, but now that imported goods are again obtainable some of these have been seriously threatened, especially the ones engaged in the manufacture of shoes and soap. The agreement between Sweden and Finland has led to a brisk trade between the two countries, Finland taking large consignments of machinery and machine parts.

American exporters will encounter more severe competition in Sweden than in the neighboring kingdoms, chiefly because of the close commercial ties that have bound Sweden and Germany. If American goods are properly introduced and actively pushed, we should obtain our share of Swedish trade. Representation in Stockholm or in Goteborg is necessary.

The Best Route for American Salesmen

An experienced traveler recommends that agents of American firms visiting Scandinavia land first at Copenhagen, the leading import, banking and distributing center. Owing to the crowded conditions, hotel accommodations should be reserved at least a week ahead. An agency in Copenhagen will take care of such matters upon the receipt of a wireless message specifying the kind of quarters desired. Upon request a representative will be sent to meet the traveler upon his arrival and to act as interpreter.

Immediate application should be made to the customhouse for a license to solicit business in Denmark. If the traveler represents only one firm he has to pay 100 crowns (about $26.80); for each additional firm the charge is 50 crowns ($13.40) extra. An affidavit stating that the applicant for a license is actually authorized to represent his firm or firms must be filed.



of fire-red balls of domestic make, and it is not entirely done away with even in the very best of our products. This blemishing tint will have to be completely eliminated before we can truly say that we manufacture fire-red glass balls in this country equal to the imported, but there is no doubt that another Christmas will see this accomplished.

A visit to one of Old Santa's American Christmas tree ornament factories is an interesting experience. Besides they are probably the only factories of the kind at present in the world, as the German ornaments have never been to any extent factory made but mostly produced in the homes of the peasants living in the vicinity of Nuremberg which, previous to the outbreak of the war, was the great toy center of the world.

When we began to make the tree ornaments in this country an effort was first made to produce them in the homes of the workmen, but working conditions are very different in America and Germany and the plan for various reasons was not a success but little actual progress towards perfection being made until we began to manufacture these Christmas novelties in regular factories.

Entering one of these places in New York city the first sight which attracts attention is a dozen workmen, all expert glass blowers, seated in a line at a long bench. In front of each man is a gas lamp which projects a long hot blue flame in which the glass tubes are quickly heated until the part subjected to the flame glows as red as fire. When this happens the glass blower takes hold of the comparatively cool stem of the glass and putting it in his mouth blows into the red hot ball at the other end in much the same way as small boys make soap bubbles. By careful practice he is able to blow the ball to any size desired, whether it be small or large. When this is accomplished he places the ball into a rack prepared for the purpose. These racks hold perhaps half a dozen balls and when they are full boys convey them to waiting girls who assort the balls as soon as they are cool into various sizes and carefully inspect each one for any imperfections in the blowing.

When the balls have been passed by these assistants to Santa Claus, they are conveyed to a skilfull young workman who, with a rubber bulb filled with silver nitrate, carefully drops in each ball a small quantity of the fluid. This process is necessary to impart to the balls the beautiful glistening effect which makes them sparkle like diamonds amid the green and lights of the Christmas tree. As the nitrate of silver would not spread of its own accord all over the balls and evenly coat them like the back of a mirror, it is necessary for them to pass through another process for this purpose. So they are passed by the young man who handles the nitrate dropper to an assistant who stands close by and who quickly dips the rack of balls into a tank filled with steam. This steam has the effect of so dissolving the nitrate that it quickly spreads smoothly all over the inside of the ball and so remains after the balls are taken out of the bath.

This process over, the ornaments are ready for the dye pot in which they are carefully immersed by women skilled in this delicate work. As the beauty and success of the product is almost entirely dependent upon this dying process it must be accomplished with the greatest care. After the balls have been successfully dyed they are placed upon long racks built against the walls of the factory to dry and drain. When this is finished they are ready for the workmen whose duty it is carefully to clip off, in a machine devised for the purpose, the long stems through which the balls are blown, leaving only an end sufficiently long to which the little gilt rings are attached from which the balls are hung by hooks from the trees.

An imperfection of the German made balls in this direction has always been that the hangers were loosely fastened to the balls and frequently came off when the ornaments were being hung on the trees. Thus many perfectly good balls were often smashed. Certain improvements have been made in the American made balls by which these hangers are so tightly fastened to them that there is little or no danger of their coming off if handled with the slightest care by Santa when he is dressing the tree.

The final process in the production of the Christmas tree ornaments is the inspection. Each ball is carefully gone over to see that the dye, the fastening, and the silvering are all correct and that the ball has not been cracked in any of the processes through which it has passed. After inspection the balls are packed for shipment to the retailer in pasteboard boxes, each ball having a little compartment of its own very much as eggs are packed in a crate.

While the retail prices for the American made Christmas tree ornaments are as yet somewhat higher than the figure at which similar German made goods were sold prior to 1914, at the same time there is not much difference, and the purchaser has the patriotic satisfaction of knowing that he is furnishing Santa with something that is manufactured in the home land.

Submersible Motors

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the pump and its small size make it extremely portable and give to it the further advantage of occupying very little space. Should an accident happen and any of the ship's compartments be perforated, whatever the cause, whether it be grounding, or collision, or explosion, the pumps can be lowered into the damaged compartments and instantly started although under water. As it may easily happen that the engine room may be affected or even put out of action it is a good plan to have emergency electric generators driven by oil engines placed on the upper deck. These are not only available for working the pumps, but provide an emergency means of lighting the ship. We all know the terrible confusion that may ensue if the lighting on board fails at a time of accident, and how easily it intensifies panic.

The combined pump and motor is a drum-like contrivance. Its construction is simplicity itself. It consists of a motor actuating a centrifugal pump. To it is attached an electric cable. The pump is slung into the water, the current switched on and instantly the water is being thrown up at the rate of hundreds of tons an hour. No longer dependent on suction the pumps can work at any depth and still cast up their great water spouts.

While, of course, everything possible has been done in the building and equipment of modern passenger steamers to minimize the risk to human life by providing watertight compartments, the fact still remains that in the majority of ships the pumping power available is woefully inadequate to cope with any serious leakage. As an emergency pumping power the value of the submersible pumps can hardly be rated too highly. It is of course, important that ships should have an ample supply of electricity available for the working of a number of these submersible pumps, and also to make it possible to give assistance to ships not so equipped. This can quickly be done by putting on board the disabled vessel one or more of the submersible motors connected by cable to the electricity supply of the ship rendering help.—*F. C. Perkins.*

LEVERAGE

Leverage enables small weights to lift big loads—small power to exert great effort.

Torbensen Internal Gear is the leverage principle logically applied to the driving of a truck.

Torbensen drives at the wheel and near the rim.

Whether tugging through mud or running at high speed, Torbensen Drive delivers maximum engine power to wheels with lowest consumption of gas and oil.

The internal gear principle permits us to use a small jackshaft, small bearings and a forged I-Beam axle which, although unbreakable, is light in weight.

There is a total saving of over 250 pounds unsprung weight. One pound of unsprung weight is equivalent to nine pounds, carried above the springs, in its effect on tires. Torbensen saves Tires.

Torbensen keeps down repair bills, stays on the job and saves money—that is why more Torbensens are in service than any other type of truck rear axle.

Largest Builder in the World of Rear Axles for Motor Trucks

THE TORBENSEN AXLE CO.
Makers of Front and Rear Truck Axles
CLEVELAND, OHIO

TORBENSEN
INTERNAL GEAR TRUCK DRIVE

Motor Trucks Increasing in Number—100 Times in Ten Years

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roads would be only 10 to 20 per cent greater per mile than that of present inadequate highways. In view of the fact that 50 per cent increase in hauling capacity gives a reduction of 15 per cent in transportation costs, the latter seems the wisest thing to do. Motor truck transportation authorities agree that money spent to build roads according to present standards is money thrown away. Now, engineers must build for the future and determine what the future demands will be and it is better to overestimate them than to build highways of insufficient capacity.

Salvaging of Metal on Battle Fields

Since the armistice salvaging of metal on a large scale has been going on in all of the war areas of the west front. Thousands of tons of old iron have been salvaged from all the battle fields. A good share of this salvage work has been performed by the troops of the Allied armies, but also a large amount of it has been done by the German prisoners of war. At practically all the railroad stations in the neighborhood of Etain and Bar-le-Duc trainloads can be seen of the crooked, rusted barbed wire entanglement rods, stacked up like cordwood, waiting for shipment. There are small mountains of miscellaneous scrap iron, and piles of heavy corrugated iron sheets are a characteristic sight in salvage dumps and railroad yards throughout the battle region. In the center and toward the eastern end of the line this work has been carried nearer to completion than at the northwestern end. In the northwest, along the British front, the salvage work has proceeded a bit more slowly, perhaps, but certainly not less thoroughly. In the winter and spring just past German prisoners of war were going over the shell-shot battle fields which had been a part of the British front, tearing down the corrugated iron shelters, picking up "duds" or unexploded shells, clearing the thickets of barbed wire and chevaux de frise, storing and piling up all the salvaged metal in the dumps, and loading it on the freight cars and canal or river barges. In the salvage dumps you can see wrecks of camions, tanks of all descriptions, great piles of metal helmets, rifles, bayonets, knives, shells and shell cases, machine guns, and, in fact, all the metal débris of warfare, but the one lasting impression made on most observers is that of acres of corrugated iron sheets, and barbed wire, and the twisted rods around which the barbed wire entanglements had been made. In a good many areas the artillery fire had been so intense that the soil has been ruined for agricultural purposes. In such cases, the salvaging is simply to remove the dangerous explosive agents, and recover the metal junk. In the agricultural districts, however, in cases where the shelling was comparatively light, and the land had been dug up to make trenches, the salvage work is closely tied up with that of agricultural reconstruction.

As a rule the first question asked by American business men coming to France, is to the extent of the devastation in the north and east of France, in the region occupied at one time or another by the Germans during the war. The question can still be answered only in general terms. There have been estimates made by our Army engineers who have reported for the benefit of the Peace Commission, but these estimates have not been made public and are not accepted as authoritative by the French Government. The latter, through its Ministry of Industrial Reconstruction, is now engaged in a minute survey of the actual extent of devastation in each locality, and the extent of the physical damage suffered by each industrial or commercial concern, as well as by private families.

To an American business man, of course, the most interesting district, from a commercial point of view, is the industrial north of France. Many have asked whether it is true that the Germans deliberately stripped plants, applied the incendiary torch, blew up factories, and wantonly broke up machinery. Douai is the most complete answer possible to this question. Every known variety of deliberate demolition of industrial plant is illustrated here. In the city itself and the immediately surrounding district, according to the prelimnary figures of the local officials of the Ministry of Industrial Reconstitution, there are somewhat over 500 industrial establishments, not including coal mines, with plant value of 100,000 francs ($19,300) or more each. A dozen of these plants have been appraised at values running from 10,000,000 up to 100,000,000 francs. Practically all the others ranged from 100,000 to 500,000 francs. Claims for indemnification, almost without exception for the whole value of the plant, are being made for practically every one in the list.

Arras, Reims, Verdun, and hundreds of villages and small cities have been pretty completely demolished by artillery fire and aerial bombing. Lille, while far from complete demolition, suffered extensively from bombs and shells. Douai, however, is the fine example of the hustling industrial city deliberately put beyond the possibility of competition, not by artillery fire or bombs but by dynamite, the acetylene torch, and the sledge hammer. In this city there are in textile mills that looked to be in fair condition from the road, and seemed to have a good deal of machinery in them, even when you look from the open door. When you come to examine the machines from nearby, however, you soon revise these first impressions. You find that every spinning frame, every loom, all the preparatory and finishing machines, have been, as a rule, so knocked to pieces as to defy repair. Heavy iron or steel framework has been practically cut through with an acetylene torch; other heavy parts of the machines have been beaten up with sledge hammers. In plant after plant you can see clearly where individual charges of dynamite have been placed under each one of a battery of boilers.

Flywheels and engines generally have been treated in the same way. At a great many plants the smokestacks have been weakened and then blown up with blasting powder; and it seems to have been good technique in this work of destruction to topple over a smokestack on top of the factory itself, thus making easier the complete demolition of the factory.

Agricultural Reconstruction in France

Everyone who has had the opportunity to go through the devastated regions during the planting season this spring has commented on the rapidity with which the land has been put back under cultivation. In the best agricultural districts in the north, where agricultural work has been carried on on a comparatively large scale, allied troops and German prisoners of war have removed the débris from much good agricultural land, and the farmers, with their assistance have again put the land under cultivation. Trenches have been filled in and land leveled off, the land plowed, so that many regions where there had been barbed wire entanglements, one row of trenches after another, and a considerable number of shell holes, now have

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pretty much the same appearance as before the war. There are various sets of statistics as to the acreage of devastated agricultural land, but the amount which it is quite impossible to work again is not large. According to the latest published figures, the total cultivated land in the invaded regions was 1,449,000 hectares (3,580,538 acres). Of this close to 1,000,000 hectares were devoted to wheat, rye, barley, and oats, 70,000 to potatoes, 215,000 to clover, lucerne and other forage crops, and 150,000 to sugar beets. According to the latest figures the invaded regions included 390,000 hectares of grazing land. The losses in live stock have been estimated as follows: 841,000 cattle, 945,000 sheep, 424,000 hogs, 358,000 horses, 2,600 mules, and 9,000 asses. The losses of agricultural implements have been estimated as follows, 55,000 plows, 39,000 cultivators, 51,000 harrows, 44,000 rollers, 13,000 seed drills, 27,000 reapers, 20,000 rakes, 14,000 tedders, 15,000 binders, 70,000 farm wagons, 12,500 thrashing machines and 90,000 harness. In the north of France the shortage of agricultural implements has been conspicuous even to the passing observer. On one large farm not far from Lille recently I observed improvised harrows made out of the cross-arms and insulators taken off fallen telegraph poles.

Possibly two-thirds of the land included in the devastated regions is being easily put in cultivation again. Agricultural reconstruction on this class of land has been rapid, and already thousands of acres of good land that it had looked difficult, but not impossible, to reclaim, have been reclaimed. The beet-sugar industry is the end of French agriculture which possibly suffered most. Although there are important sugar refineries and sugar beet working plants at Paris, Lyon, Marseille, and Nantes, the industry was concentrated primarily in the Nord, Aisne, and Somme regions, and only 50 of the 250 were outside the regions affected by the war. In a recent trade association meeting it was stated that more than three-fifth of them had been destroyed. During the war sugar-beet production dropped to scarcely one-fifth of normal. This is an industry the reconstruction of which has not been delayed; orders were placed early for reconstruction material, and the men in the industry hope for a protective tariff which will assure the future until the reconstruction work is completed.

Another branch of reconstruction which has been carried forward rapidly, through the free use of labor troops, and the assistance of German prisoners, has been the repair of roads. Hundreds of miles of roads that had fallen into a bad state from heavy traffic, or from shell fire, and from lack of repair work during the war have been put in good condition since the armistice. American steam rollers, tractors, stone crushers, etc., have played an important part in road building.

Coal and Water Power in France

THE number of sugar beet factories in Germany declined from 341 in 1914 to been afforded by the arrival of American coal. Despatches from Berlin indicate that the Ruhr region is about ready to deliver coal to France and that about one million tons may be expected the first month. Discouraging reports have been made by the Mining Society of Lens after investigating the damage inflicted by the Germans on the Lens collieries. Eighteen months will be required to pump out the water, according to their estimate, and work cannot be resumed even on the copper seams until the end of 1920. They will not be in condition to produce on their normal pre-war scale for ten years. The water is flooding out from the lower level mines and causing much damage to the country side. Powerful electric pumps, which will obtain their power from the generating station at Harnes, have been ordered for the work of clearing the mines.

Every time a nation feels the pinch resulting from a shortage of coal and a dependence on foreign sources for this essential, a stimulus is given to the development of the internal hydroelectric resources. A bill has been submitted to the Chambre des Deputés providing for the utilization of the water power of the River Rhone. Twenty hydroelectric power stations are proposed in the bill, to produce an average of 715,000 h.p. each. It is estimated that this would be equivalent to 5,000,000 tons of coal annually, or nearly one-eighth of the French coal output before the war. Fifteen years would be required for this work and the expenses are estimated at $500,000,000. The proposition as it now stands is to grant a concession for the whole undertaking to a company with a capital of $50,000,000 and the privilege of issuing bonds to ten times that amount. The bonds would be guaranteed by the State, which would appoint two-fifths of the membership of the administrative council, including the president.

American Silk Troubles

THE exodus of Italian working men returning to Italy has seriously affected the silk industry in the United States, which is handicapped by an increasing shortage of skilled workmen. Thousands are said to have left the silk manufacturing centers of this country. There have been reports that American manufacturers contemplate the establishment of silk manufacturing plants in Italy and several arguments in favor of such a plan have been brought forward. Skilled workers are scarce in this industry, whereas in Italy not only is labor more plentiful but it is believed that it will be possible to attract returned immigrants who have been trained in American mills. Waterpower may be used in Italy all year round and the cost of transporting raw material would be saved by locating near the point of production.

Germany's Power Problem

A LAW nationalizing the electric power of the German Empire has been published by the government. Germany has over 4,000 power establishments, and the splitting up of their activities is held to cause serious waste. The scheme is made imperative by the loss of the Saar coalfields and the obligation to supply coal to the Allies. The water power, which is mostly to be found in South Germany, is primarily to serve local industries, but an agreement will be made with those generating electricity from coal in central Germany. Power stations belonging to States and municipalities will not be disturbed, but the large plants belonging to private capital will be taken over and nationalized by the Central Government. The Government will buy up shares, so that the present organizations can remain intact. The nationalized works are not to be considered as a source of revenue, as the Government holds that cheap power for industry is more important than fiscal interests. The private capital in electrical power works in Germany is estimated at 1,000,000,000 marks and the use of electrical power in that country has increased from 4.43 billions of kilowatt hours in 1907 to 22 billions in 1917.

Vermont Talc

IN the Vermont district there is only one mine at present producing talc of a grade suitable for the cutting of metal worker's crayons. At this mine, which is near Waterbury, there is found in pockets a massive variety of talc which may be used for pencils. This talc is sometimes sorted out underground, but usually is picked from the belt conveyor which carries the crude rock from bins to the crusher. The blocks of talc are taken to the sawing rooms and squared off on two opposite sides on an 18-inch circular saw. This saw is on a swinging arm which is pulled forward by hand, cutting the talc block

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Not all monuments are granite—
some are Asbestos

AMID the smoldering embers of many a conflagration, there stands such a monument to fire prevention. Scarred and grimy, perhaps, but virtually undamaged.

And why?

Almost always the self-salvaged building has been defended by more than fire-proof walls—because roofed with Johns-Manville Asbestos Roofing—which is so fire-resistant that it gives full protection, even when laid over inflammable roofing construction.

There is a terrible sameness in the history of all fires that spread. They start as inside blazes—and grow big—feeding on roofs that burn.

So select your roofing, no matter what the building, with a clear sense of the fire danger and with the knowledge that your roofing will endure against time and weather.

This is a specification that only Johns-Manville Asbestos Roofing will fill—in the fullest sense.

There is a Johns-Manville Asbestos Roofing for the protection of every type of building. Read the list below and decide now which one you will select to limit your fire hazard.

H. W. JOHNS-MANVILLE CO. New York City *10 Factories—Branches in 63 Large Cities*

Johns-Manville Asbestos Roofings: Asbestone, Johns-Manville Standard and Colorblende Asbestos Shingles, Johns-Manville Asbestos Ready Roofing, Johns-Manville Built-up Asbestos Roofing, Johns-Manville Corrugated Asbestos Roofing.

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Through—

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INSULATION
that keeps the heat where it belongs

CEMENTS
that make boiler walls leak proof

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that cut down fire risks

PACKINGS
that save power waste

LININGS
that make brakes safe

FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE
Serves in Conservation

which rests on a horizontal saw table. The faced block is then sawed with an 18-inch slab saw into slabs of the width of the pencils to be made. The slab saw and the pencil saws are circular saws revolving in a fixed position and the talc is pushed through by hand. The thin slabs are cut into the various sizes of pencils with 12-inch and six-inch saws. Care is taken that the grain of the talc runs the length of the pencil. After sawing, the pencils are sorted into two grades, No. 1 and No. 2. No. 1 grade must be sound and perfect in every way. No. 2 grade may be rougher and slightly splintered at the ends.

Talc pencils at this mill are made in a number of sizes. These are packed in small wooden boxes and the boxes shipped in large crates or cases. The trade prefers a hard, tough pencil to a soft one as the point wears down less easily.

During the winter months trouble was experienced with talc pencils which were made up and shipped without much drying. They were soft and broke easily. It was found that a thorough drying and seasoning increases the durability. It is thought possible that a slow baking or draying by artificial heat might improve stock not otherwise suitable for cutting.

Small blocks or cubes of soft, pure talc are used in a number of industries for polishing wood and nails. In the manufacture of small turned-wood novelties and tool handles blocks of talc are sometimes placed with the articles to be polished in large wooden tumblers revolving about a horizontal shaft. The tumbling of the talc blocks against the wood abrades the talc, filling the pores of the wood and imparting a dull polish. The tumbling of blocks of talc with nails in a similar manner is said to facilitate the passage of nails through nailing machines used in the manufacture of wooden packing cases. The talc lubricant also makes the nails enter the wood more easily.

Soapstone

THIS is a term that has been loosely applied to several varieties of rock with differing chemical and physical properties. Some soapstones are hard, being only slightly altered from serpentine, and others are soft and contain more talc. Some varieties have a definite grain and others are composed of interlocking prismatic crystals. The difference in properties effects the suitability of various soapstones for different uses. In the construction of fabricated forms, hardness, toughness, and absence of grain are most important, but in the manufacture of foot warmers, griddles, and heating stoves for fireless cookers, resistance to heat and retention of heat are more important. Thus soapstone from certain localities in Virginia is more valuable for fabricating than for heat retention, and certain Vermont soapstones are superior for heating uses. An investigation of the properties of various soapstones and a classification by such properties would be most valuable.

The market for soapstone in fabricated form, that is, in sinks, laundry tubs, trays, table tops, etc., is dependent largely upon new building construction. During the war and the attendant depression in the erection of buildings for dwellings or commercial use, the normal market for soapstone largely disappeared, but Government orders partly compensated for this loss. After the signing of the armistice, building activity did not begin and the demand for soapstone was light. Within the past few weeks, however, conditions have begun to improve and when the building boom is fully developed the market should return to normal or even better.

The Qualities Required in Optical Glass

FIVE years ago Germany had the world beat" in the matter of making high-class optical glass for lenses of the better kinds of telescopes, microscopes, opera glasses, etc. But so great has been the progress in France and England as well as in our own country along this line that it is doubtful whether Germany will ever again enjoy her former prestige.

High grade optical glass must possess certain properties which we find admirably summarized in *La Nature* (Paris) to which we are indebted for the following data:

The most important general property of glass is that of transparency, i. e. the power of transmitting light without diminution in its amount and without irregularity or disturbance. While most glass serves fairly well for the transmission of the visible part of the spectrum, the case is different with the short waves of the ultra-violet portion and the long waves of the infra-red portion; in these portions glass is apt to display a very energetic power of absorption.

When a considerable thickness of window glass is examined by transparency it appears to be of a deep sea green in color; the best varieties of optical glass also exhibit this phenomenon, which is due not merely to the presence of impurities but also to the very nature of the substance itself, as we shall briefly explain.

According to the electro-magnetic theory of light, luminous vibrations and electric vibrations are of the same kind, differing only in the length of wave. But glass is an excellent insulator for electricity and consequently if its electrical properties were identical throughout the whole range of wave lengths, we should be able to observe no dispersion and very little refraction in the portion of the total spectrum corresponding to the luminous radiations. But there are certain bands of the spectrum in which glass acts more like a good conductor of electricity than like an insulator with the result that the corresponding wave lengths are absorbed, thus modifying the nature of the transmitted light.

The transparence of glass is also modified by the presence of any non-vitreous matter in its mass such as bubbles of gas and especially of masses of crystals which have developed at the moment when the glass was solidified. Finally there are also the striae and veins which are formed when two liquids are produced in the mass and fail to dissolve rapidly in each other. It frequently happens that if the glass has been cooled too suddenly the external part which is first to solidify brings about a formation of tension and of compression in the interior of the mass. The remedy for this is naturally to diminish the speed of cooling so that the mass may enter into stable equilibrium.

The above mentioned properties are those by which optical glass differs chiefly from ordinary kinds of glass; however, there are two supplementary properties of special nature which are of great importance. These are hardness, i. e. the resistance to pressure, which is of special advantage in the preparation of lenses and because of the resistance to abrasion which it imparts; and durability, i. e. the resistance to chemical action.

Besides these physical qualities, varieties of glass must of course meet other specifications of an optical nature such as the index of refraction (a glass is tested by the four indices of refraction corresponding to the four rays A C F and G of the solar spectrum) and the average dispersion between the rays C and F (the difference of the indices for these two rays).

THREE YOUNG CRUSOES. By William Alphonso Murrill, A.M., Ph.D. Published by the Author, Bronxwood Park, New York City, 1918. 8vo.; 218 pp.; 83 halftones, 2 colored plates.

Shipwrecked on an island in the West Indies, two boys and a girl find their lives largely dependent upon their own resource and energy. They explore the island, irrigate and work a garden, have thrilling adventures, and make interesting discoveries. The story serves as a conveyance for natural history teachings, in which the many pictures and the colored plates take a prominent part.

Latest Patent Decisions

Deliberate Infringement:—The suit herein grew out of alleged infringement of patent issued to Albert De Laski and Peter D. Thropp, assignors to the De Laski & Thropp Circular Woven Tire Co. The Miller Rubber Co., defendant appellant, denies both invention and infringement. A preliminary injunction was granted, and later the case was tried in open court upon its merits. This resulted in an opinion and decree adjudging validity of the patent as to the claims in the suit, and their infringement, and also in the present appeal. The invention relates to a tirewrapping machine. Before this suit was commenced, appellant had purchased of appellee one of its make of tire wrapping machines and is still operating it. Appellant had also purchased of the Wm. R. Thropp & Co. a tirewrapping machine which appellee claims was like the infringing device in the suit before this one, and appellant had also caused to be constructed, and is still using, two tirewrapping machines which appellee maintains were built in accordance with the patent in suit. The last three machines are the basis of the charge of infringement. Held, that the De Laski & Thropp patent is infringed by the defendant by the use of a machine purchased by, and of two machines built for, it. The point of law is that where the evidence warrants the conclusion that the infringement of a patent involved in the construction and use of machines by defendant was purposeful and inexcusable, and committed under circumstances calculated to arouse just apprehension that it would be persisted in, the remedy is to be found in equity and in an injunction. —*Miller Rubber Co. v. DeLaski & Thropp Circular Woven Tire Co. U. S. C. C. A. of Ohio.*

What Not to Invest:—The invention in the patented device involved in this suit relates to a heating stove adapted to be placed in tanks of water for the purpose of warming their contents and being particularly useful for warming the supply of drinking water provided for live stock. Action was for infringement of patent issued to Nels M. Nelson. This claim was held invalid and the bill was dismissed for want of equity. Nelson appeals. Held, that the Nelson patent is void for lack of invention. The conclusion is compelled that Nelson has not taken even the short advance step which constitutes patentable invention. The field was crowded when he entered it.—*Nelson v. Lloyd Mfg. Co. U. S. C. C. A. of Mich.*

Lack of Invention:—The patented structure indicated in the claim herein, contemplates a building construction, comprising perforate metallic lathing and a stud of malleable metal with flat prongs formed thereon and therefrom by making perforations in the flat portion of the metal strip so that the prongs are supported at one end and have metal on each side of them, projecting through perforations in the lathing and bent over the latter so as to clinch same. Sheet metal supports in the form of studding had been used to carry perforate metal lathing long before this invention of Caldwell's. The two had been fastened together by separate wire fastenings. Also, it was common to attach things to be carried by sheet metal support to that support by cutting out and striking up a prong from the support and then bending it back over the part carried. One of the older instances of such use of this attachment was to make the fastening between a tubular sheet metal fence post and the supported fence wire. To use this method of fastening to carry one or two strands of the metal lathing, instead of to carry one fence wire, cannot be considered to involve invention. The principles involved are so familiar that there can be no invention allowed.—*Berger Mfg. Co. v. Trussed Steel Concrete Co. U. S. C. C. A. of Ohio.*

No Injunction on Doubtful Gounds:—This is a suit by the Esta Co. against Alfred W. Burke, trading as the Automobile Devices Co., on motion for preliminary injunction. Denied. The bill sets up that the plaintiff is the owner, through assignment, of a patent issued to Esten Beeler upon an application for improvements in bubble-making machines. The object of the invention is to produce bubbles in large quantities of a very dry nature in any size desired for display and theatrical illusions or other purposes. The single claim is for the combination in a bubble-making machine of a tank or suitable container having a false bottom with a plurality of small holes therein, means for introducing compressed air beneath said false bottom, and a solution of bubble-making properties maintained above such false bottom. The plaintiff has used the invention embodied in the letters patent in a device for humidifying the air supply to internal combustion engine. The plaintiff is also the owner of a trade-mark for humidifiers for internal combustion engine. In connection with the ruling above mentioned by this court, the point of law is made that a preliminary injunction will not be granted in a suit for infringement of patent or trade-mark where both validity and infringement are doubtful—and jurisdiction of a suit for unfair competition is not conferred upon a Federal court by joining with it a separate cause of action for infringement of a patent or trade-mark.—*Esta Co. v. Burke. U. S. D. C. of Penna.*

Right to Make and Vend:—A man by the name of Alexander Ehmling conceived the thought of a letter stationary box which would make its appeal to purchasers through having certain features of convenience of use. One was to have the box so constructed so that it would answer the purpose of a writing desk. This was an important, if not the chief feature, and gave to the box the designation of a "desk box." Another feature was the division of a box into compartments, so that the lid, when opened, might hold the writing paper as a pad, and the body of it the envelopes, separated by a partition, which made the tray for holding pens. This required such a construction as would permit of the lid, with its pad of writing paper, folding down over the body containing the tray and envelope space. The attempt to build up a business met at first with poor success. The business was that of the "Twin Company." Alexander Ehmling was himself the chief salesman. As such he was quite successful. He was also president of the company. The box was not identified by the trade with his name, so as to be known as the "Ehmling Box," but was known under other trade names. Later on there was need to reorganize the business. This brought the present plaintiffs into it, and Ehmling, the patentee, dropped out. Then came the establishment of military camps, first on the Mexican border and later in a number of places. The sale of letter writing facilities, such as these boxes afforded, was greatly stimulated, and the business expanded eight fold. Soon a salesman of the plaintiffs, on their visits to camps and to naval and military officers, who were purchasers of navy and army supplies, found there were competitors in what the plaintiff looked upon as their special field. Among these competitors was the defendant. The court held herein that the Ehmling patent is valid and infringed by the defendant. The doctrine of the law is that a patentee has such a monopoly and right to make and vend as the award of a patent makes effective. The grant of letters patent

Latest Patent Decisions

alone gives him the rights he claims. The patent granted is prima facia valid.—*Steele v. D. L. Ward Co. U. S. D. C. of Penna.*

Commercial Success as a Measure of Utility:—This is a suit in equity by the Whitlock Coil Pipe Co. against the Mayo Radiator Co. The decree herein is for the defendant. The pleadings raised the issue of non-infringement and invalidity. The patent refers to the invention as an apparatus for effecting the cooling of one fluid by the application of another and cooler fluid, such as the cooling of air by water, or of water by air—the condensation of steam by either air or water. In the patent, the patentee says: "That portion of the apparatus to which my invention relates, in common with other and similar apparatus, comprises a series of air tubes surrounded with water passages forming part of a water circulating system, by which the water which has become heated by its contact with the cylinder will lose its heat, and by its contact with the air tubes, through which, in order to increase the efficiency of the apparatus, the currents of air are caused to move." The plaintiff sues on all the claims of the patent. The court holds that there has never been made, with any commercial success, a structure which conforms to the specifications and claims in suit. It would be unfair to claim that the defendant's device infringes the plaintiff's device when the latter has added no substantial value to the art. To sustain the claim of the infringement would be to interpret the language of the claim as broad enough to include a successful structure. Claims should cover what the patentee has invented, and nothing more. The plaintiff has failed to establish infringement.—*Whitlock Coil Pipe Co. v. Mayo Radiator Co. U. S. D. C. of Conn.*

Different Means to One End:—Suit in equity by Harry B. Ross against Overlin & Jameson. Complainant sues to enjoin infringement of its patent for improvement in motor trucks. Complainant's motor truck is adapted for picking up lumber disposed in piles, and transporting it in and about saw-mill and lumber yards, and depositing it at places of destination. The process is to drive over or straddle a lumber pile, pick it up, or raise it, by means of the motor used for propelling the motor truck, and, thus suspended beneath the frame of the truck, carry the same and deposit it where needed. Defendant Overlin has devised a motor truck of similar construction, designed to perform the same service and has secured a patent, also, on his machine. Complainant alleges infringement. Held, no infringement for, while Overlin's machine lifts, carries and deposits piles of lumber, it does not do so by the same mechanism as the complainant's truck, the lack being a principal horizontal beam, or a compound structure acting as a beam, receiving vertical load, and bearing vertically upon its supports.—*Ross v. East Side Mill & Lumber Co. U. S. D. C. of Oregon.*

Jurisdiction over Contracts:—The bill in this issue alleges that the plaintiff was the inventor of a useful invention in steam traps, and that by an instrument in writing he granted unto the defendant company the sole and exclusive right to manufacture and sell the apparatus—that he was to receive $100 within six months and $5 upon each apparatus sold by said company until he had received the sum of $1,800 in royalties. The bill further alleges that the defendants have sold a large number of steam traps covered by the patent, and on which royalties have accrued and have not been paid.

The motion to dismiss the bill must be granted.

NEW BOOKS, ETC.

BEVERAGES AND THEIR ADULTERATION. By Harvey W. Wiley, M.D. Philadelphia: P. Blakiston's Son and Co., 1919. 8vo.; 421 pp.; 42 illustrations.

Whatever man may think of water as a beverage, it is certainly the ideal thirst-quencher. Dr. Wiley begins his companion volume to "Foods and Their Adulteration" by dealing at some length with water—pure and otherwise. He follows with close scrutinies of most of the beverages in use, from coffee to Chartreuse; milk, however, is omitted, since it was considered in the preceding volume. The increasing use of fruit juices justifies the prominence here given them. It is unnecessary to say that the author's knowledge is evident on every page, and has produced a book that will doubtless be accepted as standard. The discourses touch only incidentally on health and ethics; the aim has been a descriptive treatment; this has been attained to perfection, and the botanical, industrial and geographic sides of the question are illuminated by many cuts and full-page plates.

THE NATURAL HISTORY OF STAUNTON, VIRGINIA. By William Alphonso Murrill, A.M., Ph.D. Published by the Author, Bronxwood Park, New York City, 1919. 12mo.; 216 pp.; illustrated.

These observations, taken from field notes and a diary, circle the seasons, include lists of birds, ferns, flowers, vines, and trees, and describe the smaller mammals, all in popular language; there are also several colored plates of the common butterflies.

STUDIES IN THE CONSTRUCTION OF DAMS: EARTHEN AND MASONRY. By Prof. E. R. Matthews. Philadelphia: J. B. Lippincott Company, 1919. 8vo.; 43 pp.; 30 diagrams.

These studies are designed to help engineering students and others preparing for the membership examination of civil engineering societies; the text is in the form of questions and answers, so that the student may the more readily grasp essentials while at the same time learning the art of concise self-expression. The well-drawn diagrams form an integral part of the text and aid greatly in the presentation of fundamental principles.

THE TREE BOOK. By Ines N. McFee. New York: Frederick A. Stokes Co., 1919. 12mo.; 234 pp.; 15 illustrations.

Trees are among the most beautiful and at the same time useful objects of nature, and most of us know much less of them than we should. The author seeks to correct this ignorance by a series of popular papers on the life and activities of the trees, the kinds of trees, and the forester and his work. She teaches the reader to interpret the signs that tell of a tree's history and future, and of the causes back of the wonder of changing foliage. The beginner is cajoled by fascinating lore to study the trees of his own woods and roadsides, and some fine examples of our American oaks, elms, maples and walnuts are shown in the photographic reproductions.

AMERICAN JOURNAL OF NUMISMATICS 1916. Vol. L. By Albert R. Frey. New York: The American Numismatic Society. 4to.; 311 pp.

Both beginner and advanced student will find a wealth of information in this annual, and in very accessible form. The dictionary of numismatic names gives official, popular and slang designations of coins, and describes the origin and epitomizes the history of each coin. The collector will appreciate the large number of citations of authorities, and cross references enable the consultant to find a coin under any one of its various names.

RUSSIA. Her Economic Past and Future. By Dr. Joseph M. Goldstein. Woolworth Building, New York: The Russian Information Bureau in the United States, 1919. 4to.; 103 pp.; maps and illustrations.

In the seething cauldron of Russia are vast possibilities, and natural resources and manpower must eventually give her a commanding place in civilization. The author of this enlightening work, who came here to study the problems of trade relations between the United States and Russia, appreciably clarifies for us the basic situation. In forty years his country has created wealth almost equalling the combined national wealth of England, France and Germany. It is his belief that America will "raise the banner of economic progress in the Near and Far East," and will find in Russia's enormous resources a new field for its energy. His monograph is intensely practical and abounds in graphic statistics.

THE CADENCE SYSTEM OF CLOSE ORDER DRILL. By Lieut.-Col. Bernard Lents, General Staff. Menasha, Wis.: George Banta Publishing Co., 1919. 16mo.; 124 pp.; illustrated.

This is a method of teaching close order drill that has proved its merit under the endorsement of the General Staff. In order that commands may be correctly given and promptly executed, the men are made to give them in unison, after the recommendations of Lieut.-Col. Koehler; the writer, following the Infantry Drill Regulations, has embodied this and many other good ideas in his system.

THE ELEMENTS OF ANIMAL BIOLOGY. By S. J. Holmes, Ph.D. Philadelphia: P. Blakiston's Son and Co., 1919. 8vo.; 402 pp.; 249 illustrations.

This is a high school textbook that endeavors to avoid stereotyped methods and presents its subject in a stimulating way. It deals first with the animal kingdom, since acquaintance with this is generally admitted to be necessary to entering the field of physiology. The role of bacteria in disease is given considerable space, and the final division of the work takes up such matters as divergence and adaptation, heredity and human improvement, but does not touch upon sex hygiene, which it is thought best to leave to the discretion of the teacher.

THE WAY TO FLY. By "Avion." Philadelphia: J. B. Lippingott Co., 1919. 12mo.; 156 pp.; 8 illustrations, 63 diagrams.

"The Way to Fly" is designed as a practical introduction to flight for beginners. It deals with such topics as physical and mental requirements, the pilot's education and how to get it, engine routine, the airplane on the ground, the first solo flight, the landing, and cross country fling. There is a chapter on engines and another on instruments and accessories. The work anticipates a general interest in flying due, in part, to the advent of a low-priced, reliable machine, and aims at a simple, comprehensive treatment understandable to the general reader.

THE NATURALIST IN A BOARDING SCHOOL. By William Alphonso Murrill, A.M., Ph.D. Published by the Author, Bronxwood Park, New York City, 1919. 8vo.; 276 pp.; illustrated.

The author's real experiences as the only male instructor in a "Female Seminary" form the bases of this record. There are thumb-nail sketches of students, faculty, and celebrities, little touches of humor, and bits of wisdom. A collection of "Quotations Relating to Man" occupies almost a half of the book, and here we meet with authors from the staid Confucius to the emancipated George Sand. Possibly George Sand had a wider knowledge on some phases of this subject than Confucius.

PETROLEUM. By Albert Lidgett. New York: Isaac Pitman and Sons. 12mo.; 168 pp.; illustrated.

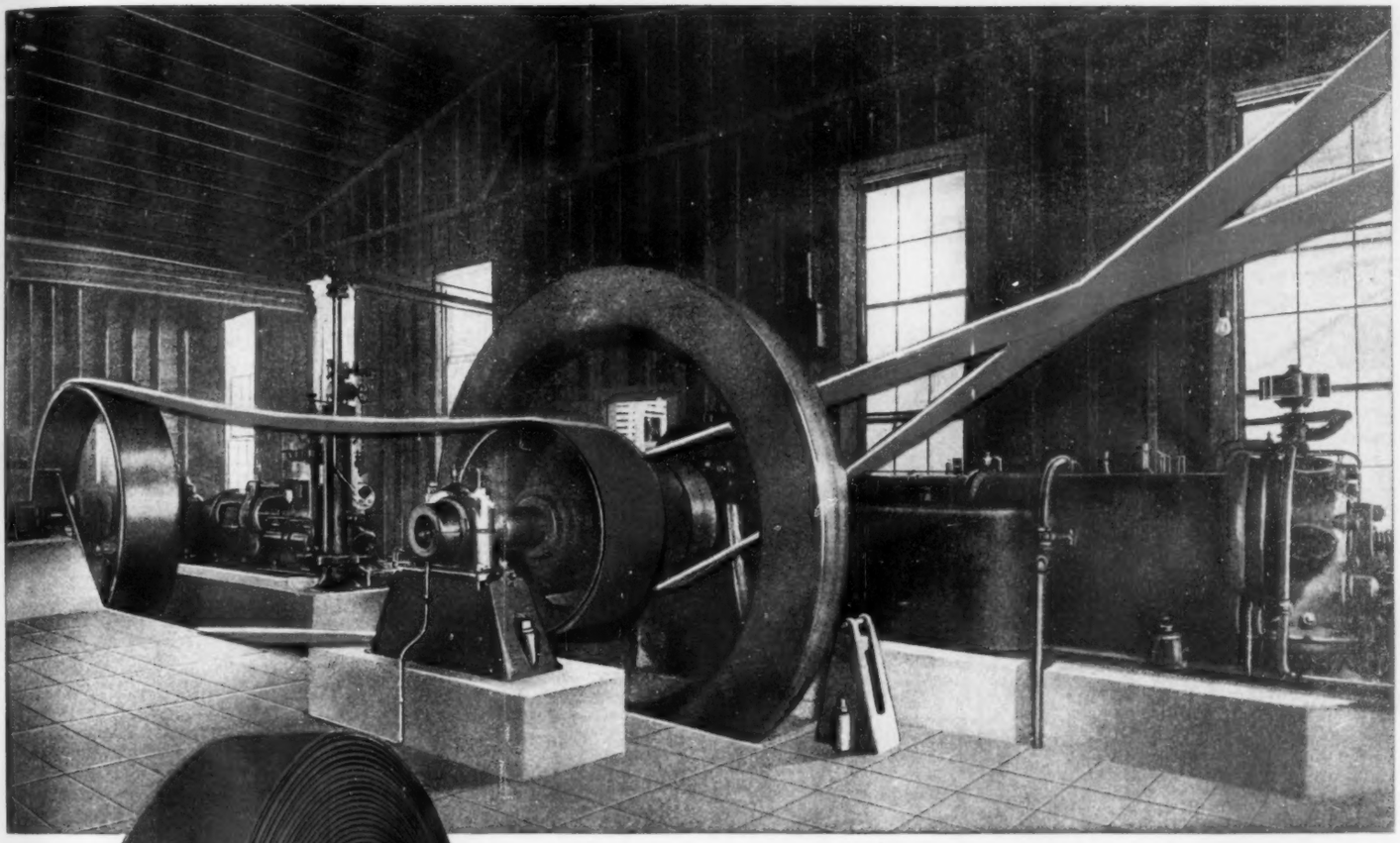
"Petroleum" is a distinct accession for the Common Commodities and Industries Series, dealing as it does with what is daily becoming more and more necessary to our civilization; for we are living in an age of oil whose demands are alarmingly in excess of the visible supply. The chief phases of the industry are dealt with in language intelligible to the general reader, including the part played by petroleum in the war. The more notable enterprises receive brief historical notice, and the final chapter of statistics condenses many vital facts into a minimum of space.

ANALYSIS OF BABBITT. By James Brakes-Troy, N. Y.; Allen Book and Printing Co., 1919. 8vo.; 169 pp.

The author has written, for mining, civil, electrical and mechanical engineers of some analytical training, a condensed, practical treatise on the analysis and manufacture of babbitt. Of methods and formulas new and old, the most satisfactory have been selected for this handbook. The analysis of white metals and white metal alloys is included, and a well-chosen bibliographical list adds to the usefulness of the work.

SALT AND THE SALT INDUSTRY. By Albert F. Calvert, F.C.S. New York: Isaac Pitman and Sons. 12mo.; 151 pp.; illustrated.

Salt is a staple the world over. Caesar found the natives of Cheshire obtaining brine from natural springs, and taught them the secrets of boiling and precipitation. Latterly, processes have been rather jealously guarded. The author has been fortunate enough to have been given access to these workings, and his book confines itself for the most part to this district of England. Here the saltmen have created a history of monopoly, waste, and obsolete methods that make interesting reading and incidentally disclose valuable facts.



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RAINBOW Friction Surface Belt is built with one idea only—the maximum of satisfactory Belt service.

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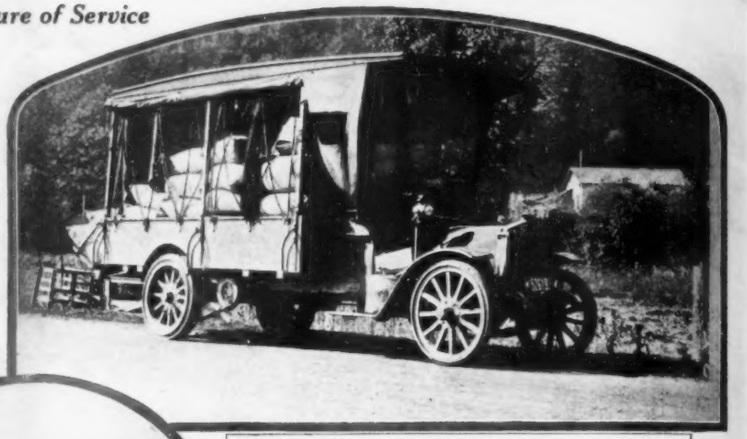
VALUE RECEIVED-

and Still These Veteran Federals Give Daily a Full Measure of Service

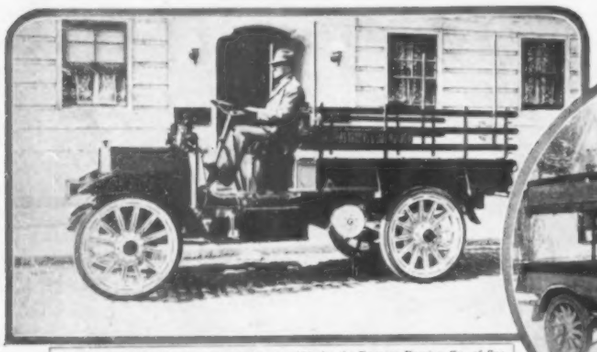
The merit of a motor truck is most convincingly presented in terms of faithful performance over a long and busy period of years.

Pictured on this page is a number of old Federals whose long years of service—*and the fact that each of them is still in daily usage*—make them of far more than passing interest to present day truck owners, prospective buyers and dealers in motorized haulage units.

Ranging in age from six to ten years—having traveled from 50,000 to 200,000 miles each—these and thousands of other veteran Federals add appreciably to the enviable reputation which their more modern "brothers" have inherited. From 1909 to 1919, all Federal models have embodied those features of structural ruggedness which make for a "value received" investment in a motor truck.

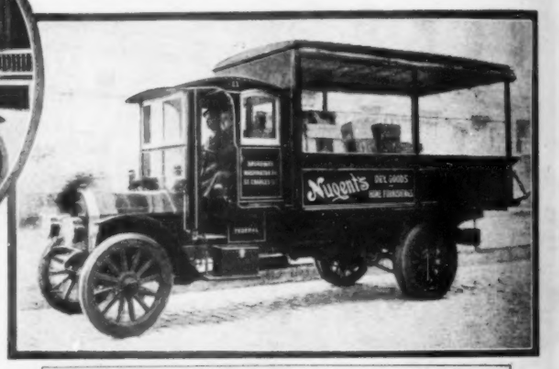


Model "H," 1914, Federal which has been in use by the Redmond Trading Co., of Redmond, Wash. for the past five years. Mr. F. A. Reil, one of the owners, writes us: "The truck in general gives excellent service. If we are ever in need of another truck, it will surely be another Federal."

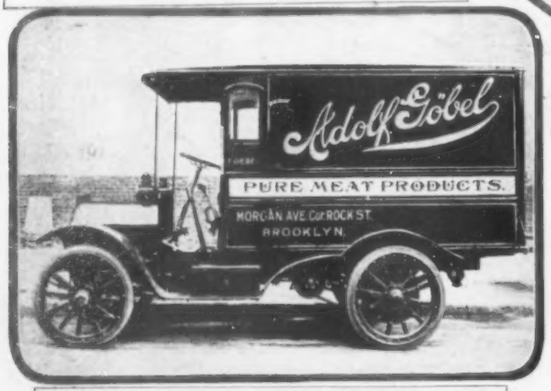


This is Federal No. 212, purchased in January, 1912 by the Emmons Draying Co., of San Francisco, Cal. Needing a larger truck in 1916, this concern sold No. 212 for $1100. It is still in service in the hands of the new owner. The original cost was $1800. The Emmons people now operate a fleet of nine Federal trucks. Their first Federal evidently convinced them that a better truck for their business couldn't be made.

In 1910, Mr. M. L. Pulcher, Vice-President and General Manager of the Federal Motor Truck Company, personally accompanied this—the first Federal manufactured—to its destination. There its purchaser, the National Pop Corn Works, put it to work, and it has been working uninterruptedly ever since—its record for performance to nearly 100% as to seem almost incredible.

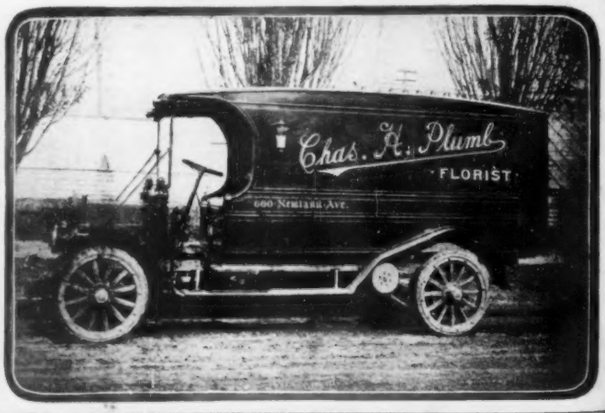


Federal No. 671, purchased Feb. 2, 1910 by B. Nugent & Bro., of St. Louis, Mo. The present Nugent fleet of six Federals is convincing proof that old 671 measured up to all requirements. And the truck is one of the six Federals in the present fleet—doing its daily "trick" with the other five.



Federal No. 660, an old model "C". The owner, Mr. Frank Giebel, of Brooklyn, N. Y. writes us, "This Federal was purchased in 1912, and in seven years of daily operation has given the highest type of satisfactory service."

A seven-year-old Federal owned by Chas. H. Plumb, a Detroit florist. Mr. Plumb paid $1800 for this truck in 1912, and recently told us he would not sell it unless he could get more than $1500—that the truck in all practical respects is as good as the day he bought it. And don't forget—a florist's truck sees service seven days a week.



Here is old "Jennie"—a model "D" 1912 Federal owned by C. D. Brannon of Butcher Ranch, Cal. Used entirely among mountain roads and but rarely traveled trails, this Federal, barring two minor accidents, has given its owner no trouble whatsoever. Mr. Brannon writes us, "I have received wonderful service from it. I surely would take pleasure in recommending the Federal to anyone in need of a motor truck."

This Federal is nine years old, and yet as the photograph shows, is doing the hardest kind of heavy duty haulage under the most difficult of working conditions. The present owner, R. W. Manning, of Prairie, Wash., has owned the truck two years and reports that he has never once had it overhauled. The truck makes three five-mile trips each day between forest and railroad.

Federal Motor Truck Company — Detroit, Michigan